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The Outlook

The Fleet Air Arm in War

AN article on the problems and needs of the Fleet Air Arm appeared in our issue of October 22nd, and in this week's issue we publish a résumé of a lecture delivered before the Royal United Services Institution on the war record of the same branch of the Royal Navy. The lecturer, Lt. G. R. M. Going, R.N., is a very gallant pilot, who came down in the Mediterranean just before the start of the attack on Taranto, but was picked up, dried, and was just in time to take off with his squadron. Afterwards he lost a leg, but now, to his great joy, he is back at sea again, though not able to serve in the air. All our readers, we believe, will agree that his lecture is extremely interesting, and the full text of it will appear, we understand, in due course in the *Journal* of the Institution.

Lt. Going emphasised various points which the public would do well to bear in mind. One of these was that of the five aircraft carriers which the Navy has lost in this war only one (H.M.S. *Hermes*) was sunk by air action. He told us, what few of the public knew, that the Australian-built seaplane carrier *Albatross* has been out on submarine patrol during this war. From him we learnt that mine-laying from the air was an idea of the Admiralty, which Bomber Command has since adopted. In particular, he gave us all a good idea of the extraordinary versatility of the Fairey Swordfish, but also showed that the type was overworked; in fact, that it was sometimes worked to death. The Admiralty still finds the Swordfish indispensable for certain tasks, though it admits that the type is now practically obsolete for Fleet actions.

Incidentally, after the paper had been read, the lecturer revealed the interesting detail that the *Bismarck* was first spotted by a naval aircraft stationed in Scotland. This machine had been prepared for target towing and had hardly any equipment, yet it followed the *Bismarck* to the limit of its range.

At the end of his lecture, Lt. Going made the claim that the Fleet Air Arm deserves the highest priority in choice of personnel, in training facilities on shore, and in the design and production of faster and more heavily armed aircraft. One can easily follow his train of reasoning, which we take to be as follows: The Royal Navy must remain supreme at sea, for otherwise the victory of the United Nations will be postponed until the United States is able to shoulder the whole burden—and in the meantime Britain would probably starve and might be invaded; the Royal Navy cannot maintain its supremacy without a first-class air arm; therefore the whole prospects of a British victory hang upon that arm.

There is really no flaw in that argument, but still we cannot agree that it justifies a claim for such absolute priority. There are other essentials for victory, such as Fighter Command, whose failure would be disastrous. We must never forget big guns, which are essential for both Navy and Army, and there are other things, too. Priority, in fact, is a dangerously loose term.

But everybody must agree that where the Fleet Air Arm feels itself short of the necessary best, the deficiencies certainly ought to be made good. It deserves the best fighters and the best torpedo-aircraft which can possibly be produced by the aircraft industry. It would be a crying shame if the authorities responsible for such designs and supplies were to take up the attitude that the F.A.A. has done extremely well with material which was not quite first class, and its air crews can be trusted to go on doing so. The design of carrier-borne aircraft deserves as careful study in this country as it has received in the United States, and it is sincerely to be hoped that henceforth it will get it.

Comparing Notes

NOTHING could be more useful in promoting a better understanding between this country and the United States of America than reciprocal visits of representatives of the two nations. In no sphere of activity are such visits more beneficial than in that of the air, and thus Great Britain has been unfeignedly glad to receive the American aircraft mission which has been paying a return visit for the British aircraft mission which toured the United States recently.

So far the British mission has not disclosed to the British public its impressions of aircraft and engine production in America, but the American mission which has been inspecting British aircraft and engine factories has had an opportunity to express its satisfaction with what it has seen in this country. The whole community heard the views of Mr. T. P. Wright on the radio last Sunday, and those views appeared to be shared generally by other members of the American mission.

One fundamental difference between conditions here and in America which has impressed the American representatives is our extensive and successful use of dispersal. One can imagine that American constructors, accustomed as they are to huge factories under one roof (with all the advantages which that system confers), would expect our relatively small and scattered units to suffer a diminution of output. The production figures given to the mission, and the evidence of its own eyes, dispelled that idea, and the view was generally held that we had done our dispersal very skilfully.

The relatively small use made in this country of conveyors in factories was commented on, but it was realised that the comparatively small size of our factories renders the use of conveyors less profitable.

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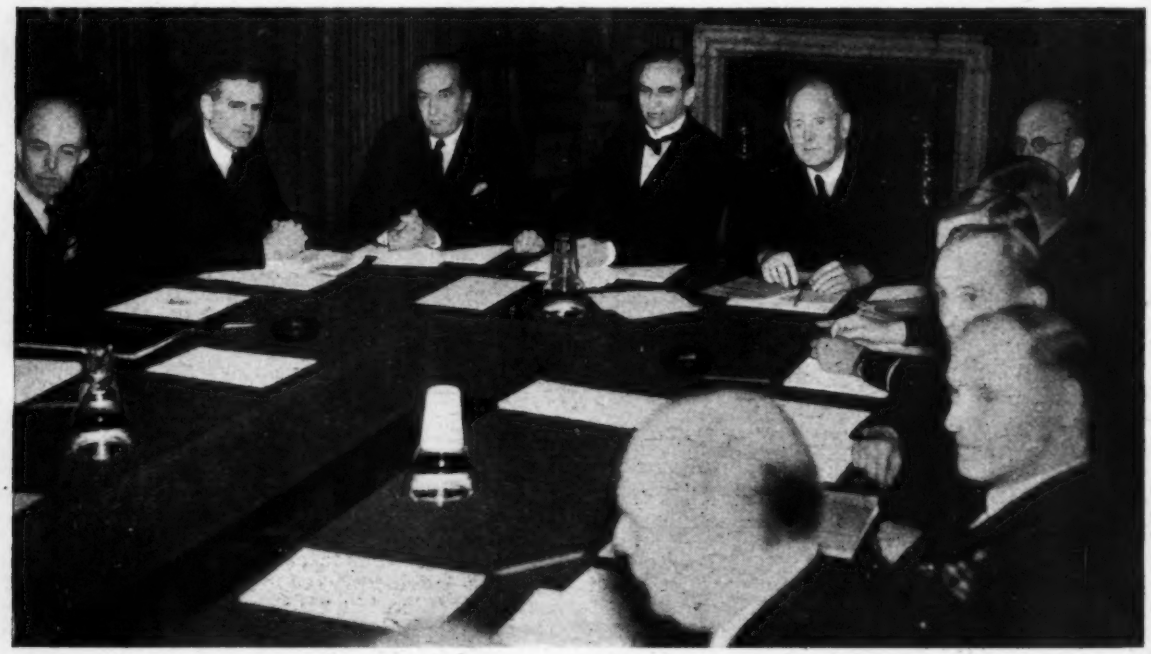
In this country there has been much criticism of the introduction of modifications deemed necessary as a result of operational experience. That, quite naturally, was particularly so in the earlier days of the war, when delays in production were, undoubtedly, caused by "mods." The Americans appear to have been much impressed by the flexibility of our industry which permits such modifications to be made at an early date.

At a conference between representatives of the Press and members of the American air mission, Col. Llewellin quoted as an instance of co-operation the fact that the De Havilland Mosquito airframes built in Canada are to have Rolls-Royce engines built in the United States. The statement evidently referred to the Merlin XX with two-piece cylinder blocks built by the American Packard works. The arrangement is obviously a sensible one, since the engines can be sent to Canada and installed in the aircraft there, after which the machines will, presumably, be flown across.



EMPIRE AIR TRAINING CONFERENCE. Representatives of the Governments of the United Kingdom, Australia and New Zealand at the conference held in London on October 16th to discuss arrangements for the continuance of the Empire Air Training Scheme. Left to right: Air Marshal R. Williams, C.B., C.B.E., D.S.O., R.A.A.F., Captain Balfour, M.C., M.P. (Under Secretary of State for Air), Mr. S. M. Bruce, C.H., M.C., (High Commissioner for Australia), Sir Archibald Sinclair, K.T., C.M.G., M.P., (Secretary of State for Air), Mr. W. J. Jordan (High Commissioner for New Zealand), Mr. L. J. Banford (Secretary), Mr. T. A. Barrow (Air Secretary for New Zealand), Air Marshal Sir B. E. Sutton, K.B.E., C.B., D.S.O., M.C. (Air Member for Personnel) and Sir A. W. Street, K.C.B., K.B.E., C.M.G., C.I.E., M.C. (Permanent Under Secretary of State).

War in the Air

The Desert Battle : Fighting Round the Solomons : Aleutian Submarine Base Bombed : The Alaskan Highway

ICELANDIC WHITLEY : White-bellied Whitleys at a Coastal Command station in Iceland. The white paint has been found to be excellent camouflage against clouds.

GENERAL F. HALDER, Chief of the German General Staff, has been dismissed by Hitler. He is reported to have been of the opinion that the greatest peril which now threatens Germany comes from North Africa. In that he agrees with plenty of other authorities, though it is doubtful whether Hitler shares the view. Let us all hope that General Halder is right.

Accounts of the early stages of General Montgomery's advance are chiefly a chorus of praise for the grand assistance which the air arm gave to the ground forces. Every form of operation of which aircraft are capable has been practised. Some squadrons have been playing the part of field artillery, bombing targets on or just behind the battlefield which the guns would have shelled if they could have reached them ; others have been acting as long-range artillery, damaging the enemy forward airfields (if the word "field" can appropriately be used of the desert), and especially the fighter grounds at Daba and Fuka ; others, again, have been piling bombs into the harbours of Mersa Matruh, Tobruk and those farther back ; while fighter squadrons have divided their energies between keeping the ring overhead and strafing such ground targets as were likely to respond to the arrival of a 20-mm. shell in their interiors. Several times the enemy began to mass troops of one sort or another for counter-attacks, only to have to scatter again when the British squadrons began to blast them with bombs.

Of course, all this account of air activity does not mean that the ground forces were inactive. The infantry were mainly responsible for the first stages of the British advance, while the ground artillery kept up a bombardment the like of which had never before been known in Northern Africa. The Navy also has bombarded Axis ports from the sea. The struggle is likely to be a lengthy one, and we shall revert to its progress later on.

Stories are getting about concerning the panic in Genoa during the R.A.F. bombing raids on the place, and one of them, which came through a German-controlled radio, suggested, if it did not actually aver, that over 350 people were crushed to death in the mad rush for shelters. Many, perhaps most, Italians feel very little enthusiasm for the war, and they must feel deeply aggrieved at being bombed for the crimes of their rulers. Innocent Ethiopians had to suffer horribly during Mussolini's invasion of Abyssinia, and the whirligig of time is now bringing its revenge.

BEAU'S NOSE : A close-up of the cockpit of a Beaufighter in the Western Desert.

The Americans have announced that the Japanese had established a submarine base at Kiska, in the Aleutians, and their heavy bombers have been attacking it several times. One day Liberators went there with an escort of Lightning fighters, and next day Fortresses followed on without any escort, trusting to their own fire power to keep off Japanese fighters. As a matter of fact, no enemy fighters tried to dispute the air with the Americans, though there was a good deal of A.A. fire from the ground.

Down in the South-West, a confused

WAR IN THE AIR

CREUSOT RAID: The astounding sight of 94 Avro-Lancasters at 0 ft. on their way to bomb the Schneider works at Le Creusot. They are passing over Montrichard on the River Cher in the department of Loir et Cher.

battle, sea, air and land, has been going on round the Solomons for the possession of Guadalcanal. So far little has been made public about it, but it is notable that the American Government has changed the Admiral in command in that area. Aircraft have been playing a very large part in this battle, and it is to be hoped that the Americans have enough machines there to do all that has been expected of them. It is also to be hoped that their losses in cruisers have been made good.

The Japanese cannot feel very exhilarated at the news (if the public are allowed to learn it) that the great Alaskan highway from Edmonton to Fairbanks, in Alaska, has been opened. Many airfields are situated along the course of the road. Lorries are now running along the road, and a great massing of American strength for attacking Japan by sea and air is foreshadowed. The base at Fairbanks also means a new way of communicating with Siberia, and perhaps getting certain sorts of supplies into Russia.

Likewise it is not good news for Japan that the Americans have 13 new aircraft carriers under construction, while President Roosevelt has signed an order for building 25 more.

Speaking of the war in the North, it has just been announced that since the summer units of Coastal Command have been stationed in northern Russia, where their long-range machines have been active on reconnaissance in connection with convoys. Watching the movements of the ice is an important part of their duties.

Air Action in Burma

NOT long ago the Japanese in Burma made another isolated air raid on one of the smallish towns on the eastern coast of the Madras Presidency. American bombers have also made heavy attacks on Japanese airfields in Burma, notably Lashio at the end of the now useless Burma Road to China, and Myitkina, where the damage was so heavy that it is calculated that these will no longer be suitable as main bases for enemy fighters. But they are evidently still capable of use as advanced landing grounds, for in a return raid on the Americans in Assam the Japanese were able to send a fighter escort with their bombers. There are several advanced American fields in the neighbourhood of Dibrugarh, and the Japanese succeeded in taking them by surprise. It appears that they did a good deal of damage to American aircraft. One estimate gives the heaviest raid as made by 95 Japanese machines, 50 of them bombers and the rest fighters. From the Dibrugarh area the Americans have been running an air ferry service between India and China, and the object of the Japanese was evidently to disrupt that as much as possible.

In other raids on air bases in North-East India the Japanese were not so fortunate, and American fighters shot down a few raiders and damaged others.

Five Japanese bombers flew up from Burma one day into China and bombed a town and road in Yunnan province. On the other hand, the Chinese Air Force, of which little has been heard for a long time, has begun to take vigorous action.

Chinese bombers accompanied by fighters made a raid on a Japanese airfield in South Shansi province. They dropped tons of high explosives, while the fighters set fuel depots on fire and damaged Japanese aircraft on the ground as well as military trucks. There is also an account of Chinese fighters attacking 10 Japanese fighters which were escorting a bomber formation, and shooting down two of them after a dog-fight.

These incidents suggest that the Americans have now succeeded in getting aircraft through into China, and they may have helped to train new Chinese pilots. It is certainly encouraging to hear of the Chinese Air Force in action again, and taking definitely aggressive action.

The time may not be far distant when Americans and Chinese together

ITALIAN FIGHTER-BOMBER: The 1,150 h.p. D.B. 601 engined Reggiane Re 2001 fighter adapted as a bomber. As a fighter it is credited with a speed of 362 m.p.h.

WAR IN THE AIR

ENEMY AIR LOSSES TO OCT. 31st.

	Over G.B.	Over Continent	Middle East
Oct. 25	0	0	14
" 26	2	1	21
" 27	0	0	22
" 28	0	0	10
" 29	0	0	4
" 30	0	0	5
" 31	13	0	13
	15	1	89

Totals : West, 6,453 ; Middle East, over 4,882.

may give the islands of Nippon another taste of bombs.

The Germans have attempted a daylight reprisals raid for the R.A.F. attacks on Le Creusot and Milan, but their idea of reprisals is not destruction of factories, but slaughter and devastation in a purely civilian town, in this case Canterbury, of no military importance, but famous for its cathedral and other ancient buildings—and not too far inland. They sent over some 50 raiders in four waves, all or nearly all consisting of fighter-bombers or fighters. A squadron of British fighters met some of them before they crossed the coast and shot down five Fw 190s. Other fighters destroyed another German, and A.A. fire got three more. During the following night Do 217s made scattered raids, but lost four machines.

Progress in Egypt

THE battle in Egypt in its early stages has been fought mainly by the infantry in close combination with artillery on the ground and in the air. Armour, which has been rated the decisive arm in desert fighting, has not yet been heavily engaged on either side. The British six-pounder anti-tank gun seems to have inspired the Germans with a healthy respect, while the British commanders have no intention of risking another Battle of Knightsbridge. Consequently, the advance has been slow and methodical, but it has been continuous. One of the healthiest signs is that Axis tankers have been trying to work their way along the coast up to Tobruk. This is a new move, and shows that Rommel is willing to risk much to get petrol as quickly as he can. Allied torpedo-aircraft have sunk some of these craft.

ALAMEIN AIR STRAFE : Observers of a South African Air Force squadron reporting to the intelligence officer after a successful raid.

BRITISH & U.S. AIR LOSSES TO OCT. 31st.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Oct. 25	0	0	0	3
" 26	0	0	0	10
" 27	0	0	2	6
" 28	0	0	0	4
" 29	0	3	0	1
" 30	0	1	0	3
" 31	3	3	4	5
	3	7	6	32

Totals : West, 4,812 ; Middle East, about 1,852.

A squadron of the Royal Hellenic Air Force made a special sortie on the anniversary of the Italian invasion of Greece, and shot up the headquarters of an Axis division without losing a single pilot.

There has been some increase of enemy air activity over the battle, but the United Nations undoubtedly have the upper hand in the air, and are using it with the utmost determination. Its effects have been seen in many ways, not only in defeating efforts of Stukas to bomb the British ; but also in destroying Ju 52 troop-carriers and other transport.

The enemy has for the time being acknowledged his inability to squash Malta, and for several days and nights there were no raids. Probably all his bombers have been needed in Egypt.

In the Solomons sea-air fight the Americans have lost the *Wasp* and another unnamed carrier, but have bombed many Japanese ships and claim to have destroyed some 100 Japanese aircraft.

The Russians have brought up more fighter squadrons to the Stalingrad battle.

NOT A TOTAL LOSS : An aerial photograph of an Allied tanker on fire after being torpedoed. The fire was got under control and the tanker towed to port.

HERE AND THERE

Pathfinder Badges

AS an official recognition of the very special nature of their duties, R.A.F. bomber pilots and their crews who find the target and start fires to light it up for the main attack are to have a distinguishing "pathfinder" badge.

This takes the form of gilt wings which will be worn on the flap of the left breast pocket, beneath the usual wing or wings.

Price of "Flight" Photographs

FLIGHT photographs of aircraft, which are of post-card size, have now been increased in price to 6d. each, or 5s. per dozen.

Lists of the photographs available, together with one specimen picture, are obtainable for 6d. from this office.

Recent additions to the range include Avro Lancaster, North American Mitchell, Messerschmitt Me 109F and Me 110, Dornier Do 217E, Junkers Ju 87B and Ju 52, Focke-Wulf Fw 190 and Condor.

The Ramming Russians

RUSSIAN fighter-pilots have made a special study of how to ram an enemy bomber and "get away with it," according to an article in the October issue of the American magazine, *Flying*.

The method attempted whenever possible, it appears, is to clip the tail control surfaces of the bomber with the airscrew of the fighter, and this has been successfully accomplished on many occasions without even the loss of the fighter, much less its pilot.

African Supply Route

WE have grown accustomed to the regular flow of aircraft across the Atlantic; it is one of those things we now take for granted which, before the war, made front-page news.

What is perhaps not generally appreciated is that for the past two years an equally "romantic" bit of flying has been going on quietly in Africa; in fact, it has been a hush-hush job until quite recently.

This is the supply route from a West African port to Egypt, and thousands of British and American aircraft have been delivered to the Middle East Command, crossing 6,000 miles of equatorial jungle, bush and desert, week in and week out.

Before the war this flight would have hit the headlines just as hard as did the various ocean hops between Britain and America.

Tilted Tails

TAILPLANES with a dihedral angle are becoming more and more common. The Bristol Beaufighter is one of the latest types to succumb to the new fashion, and it is reported that all existing "Beaux" are to be so modified.

It would not be at all surprising if certain other familiar types developed "tilted" tails, for it has been discovered that the tendency to swing during the take-off run (which varies considerably in degree with different types) is materially reduced by this simple expedient.

Duplicated Airgraphs

AIRGRAPH mails lost in transit will in future be duplicated as a normal arrangement. Should exceptional circumstances render this course impracticable at any time, the fact will be announced.

One of the incidental advantages of the airgraph letter is that it can easily be duplicated, but the first occasion on which this has been done was in the case of the mail lost with the flying boat *Clare*.

The *Clare* was carrying airgraph mail from India, Africa, and the Middle East, and on her loss being reported the G.P.O. cabled these countries and asked for copies of the original airgraph films to be sent here by air.

Within three days of their arrival in this country enlargements had been delivered to the addressees.

U.S. Women Aircraft Workers

ACCORDING to the Aeronautical Chamber of Commerce, there are now 39,000 women employed in productive capacities in the American aircraft industry, as compared with only 1,900 at the end of last year.

"What was once looked upon as a dubious though necessary expedient to meet war demands," says *American Aviation*, "is now an accomplished fact."

The above total, of course, excludes many thousands of women in clerical positions in the industry.

Victory Weld

AMERICA, which has a monopoly of helium gas, is reported to have found a particularly useful job for it in the war effort. The Northrop research engineers have successfully applied it to the welding of magnesium after some two years of experiment.

In the new "heliarc" welding process, the helium is fed to the weld through the torch itself so that a shield of the inert gas envelopes the molten metal and prevents oxidation. No flux is then necessary, and the old bugbear of subsequent corrosion is therefore eliminated.

Since the successful welding of magnesium was hitherto regarded as impossible, this Northrop process has come in time to make possible the use of this material in aircraft production. Magnesium alloy is not only lighter than aluminium for the same strength, but it is one of the most plentiful metals in America. Moreover, there is nothing tricky about the actual operation; quickly trained welders—many of them women—are already said to be doing expert work with this new heliarc torch.

THE LION HAS——TEETH! The power-operated gun-turret has been a vital factor in the operations of British and American aircraft. There are several different types, and our picture shows Boulton-Paul turrets in the course of assembly on "trolleys" that permit simultaneous work inside and outside.

Aircraft Carriers steaming in line abreast on convoy duty in the Mediterranean.

WAR RECORD of the FLEET AIR ARM

How Carriers Helped the Navy in Its Three Major Duties : Great Work by Swordfish, Fulmars, Skuas and Hurricanes

LIEUTENANT G. R. M. GOING, R.N., a pilot who took part in the Taranto attack and afterwards lost a leg delivered a lecture under the above title on October 28th before the Royal United Services Institution. Rear Admiral C. S. Holland, a former Captain of the *Ark Royal*, was in the chair.

The lecturer said that if we wished to study the work of the Fleet Air Arm we must consider the naval war and see how that arm has assisted in its conduct. He said that he would deal with the three major functions of the Navy, namely, (1) the maintenance of our sea-borne trade and communications; (2) the disruption and distribution of the enemy's maritime trade and enforcement of the blockade; and (3) co-operation with the sister Services.

In the first few weeks of the war the available carriers were used in company with other warships on hunting submarines in areas where they were known to be operating. Their only protection overhead was Skuas and Gladiators, and they had also inadequate protection against submarines, which resulted in the loss of the *Courageous* by submarine attack. It was soon realised that this use of carriers in the narrow seas was unsound.

From October, 1939, to January, 1940, five carriers, the *Ark Royal, Glorious, Eagle, Hermes* and *Albatross* were employed on trade protection. At the outbreak of war there were over 2,000 British and Imperial merchantmen scattered over the seas. It was the Admiralty's policy to route these ships independently to the convoy assembly ports. There was a scarcity of warships with which to cover these merchant ships, and carriers were used to give air protection as the ships made for these ports. Groups consisting of a carrier and a small covering force were operating in the South Atlantic, Indian Ocean, North Atlantic and elsewhere. Searches for enemy raiders and ocean-going submarines were also covered by naval aircraft operating from the *Ark Royal* and *Hermes* in the South Atlantic, the *Glorious* and *Eagle* in the Indian Ocean, and the *Albatross* off West Africa. At this time the backbone of the maintenance crews was still R.A.F. men, and their work was so good that cases of engine failure were very rare, so rare, in fact, said the lecturer, that "if anyone were to comment on the hazards of continuous flying over the sea in single-engined aircraft he would have been regarded as peculiar and, to put it bluntly, windy."

When the convoy system got fully going, the more important convoys, such as those with troop transport, had carriers as part of their escort. These had to provide fighter patrols when the convoy was within range of shore-based aircraft and also to search for surface raiders and submarines.

When the convoys were within range of shore-based aircraft, Coastal Command carried out these duties, and carriers had to undertake it when outside that range. When France fell and the Germans had had time to organise the airfields in that country, the long-range Focke-Wulf aircraft added to the ever-present submarine menace.

Introducing C.A.M. Ships

To counter this, and pending the production of small carriers, fighter catapult ships manned by naval personnel and flying the White Ensign were introduced. These were so successful that similar R.A.F. Squadrons were formed to man C.A.M. ships, which were merchant ships carrying a catapult as well as cargo. The aircraft used by the fighter catapult and C.A.M. ships were Fulmars and Hurricanes. He described the methods employed.

The lecturer then turned to convoys to Russia and through the Mediterranean. When Italy declared war the Mediterranean Fleet was but half as strong in ships as the

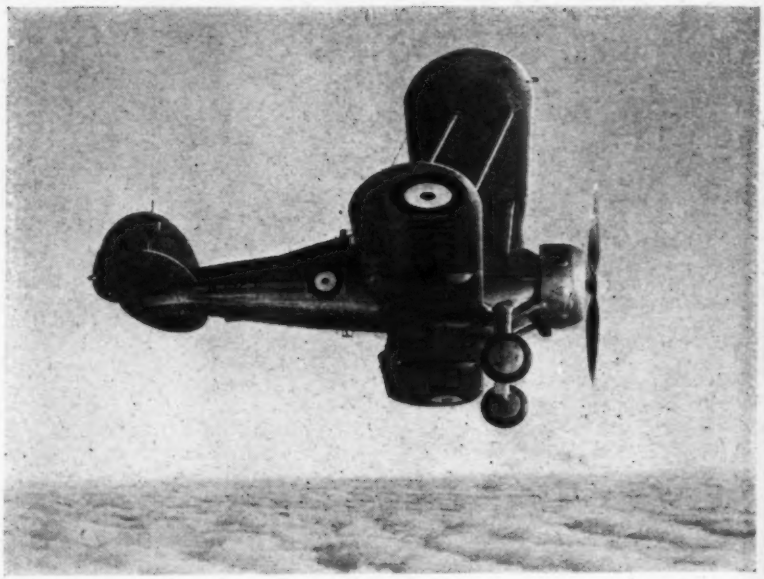
FLEET AIR ARM

Italian fleet, and this state of affairs continued until Taranto.

Italian air bases were so disposed that the *Regia Aeronautica* was able to attack shipping throughout the Mediterranean, and it became increasingly difficult to supply Malta from Alexandria or to operate a fleet off the Libyan coast. At that time the sole carrier-borne air protection for the Mediterranean Fleet was provided by six Gladiators from H.M.S. *Eagle*. The lecturer remarked, "Had it not been for the happy chance that the Italians and Germans were convinced of the efficacy of high-level bombing our losses in ships might have been heavy; as it was they were extremely light for the weight of attack met with."

Then the Admiralty began to force convoys through the Mediterranean, and the first one from west to east was guarded by warships, including the battleship *Valiant* and the new aircraft carrier *Illustrious*, as well as two anti-aircraft cruisers. The Italians attacked when the convoy was in "Bomb Alley" between the Libyan coast and Sicily; but, whereas they had previously been used to coming in almost unopposed, now they were met by an eight-gun monoplane fighter, the Fulmar, in addition to much heavier anti-aircraft fire.

From then until early in 1941, the air above the Fleet was kept almost completely clear by the use of what the lecturer called "really no more than a second-rate fighter." Shadowing aircraft were shot down the moment they approached the Fleet, and the attack which they were to have directed failed to materialise. As a result of this fighter protection, the Mediterranean Fleet was able to control the Eastern Mediterranean, an area which they had hitherto controlled, the lecturer said, "only by a startling combination of offensive spirit, impertinent audacity and great good fortune."



"Their only protection overhead was . . . . . Gladiators."

Seven Direct Hits

Early in 1941 the *Illustrious* was put temporarily out of action in the convoy battle of the Sicilian narrows, where she received seven direct hits with bombs. This left the Fleet with nothing but the old carrier *Eagle*, which could only give limited air protection. Shortly afterwards H.M.S. *Formidable* was sent to the Mediterranean, and soon afterwards the battle of Matapan was fought. But during the operations off Crete the *Formidable* was also hit. The naval operations were entirely successful during the battle of Crete, but losses were heavy. These were not surprising considering that the *Formidable* had less than a score of serviceable fighters to provide air cover to the naval forces, which were being bombarded by enormous numbers of Axis aircraft based on Melos, Rhodes, Scarpanto and other bases.

After the fall of Crete it became doubly difficult to supply Malta. Nevertheless, the island has been supplied at least three times from Gibraltar, and at least once from Alexandria, and in no case has more than 15 per cent. of the merchant tonnage in convoy been lost by air attack when under the protection provided by carrier-borne naval fighters. The majority of these losses were incurred after the carriers had turned back to Gibraltar.

The lecturer mentioned the difficulties of the convoys to Russia, for in summer the Arctic ice breaks and drifts southwards, while there are 24 hours of daylight, so that the convoys are forced within easy range of enemy aircraft based on Norway. Nevertheless, British commitments to Russia have been fulfilled in their entirety.

The lecturer next turned to the problem of surface raiders, and described the part played by the Seafox of H.M.S. *Ajax* in the River Plate action, and then went on to the sinking of the *Bismarck*. He said that the aircraft from H.M.S. *Victorious*, which made the first torpedo attack, had only joined their ship less than a week before. They returned to their carrier at night after that attack and landed on without loss.

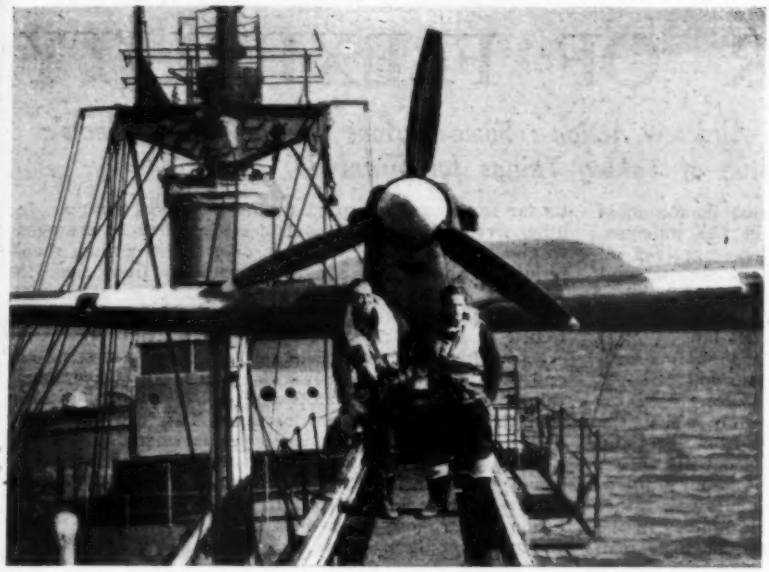
He did not deal with the escape of the *Scharnhorst* and her consorts from Brest, as the six ill-fated Swordfish, which were all lost, were the only naval aircraft involved, and they had been stationed there for other purposes.

Turning to the second duty of the Navy, namely, attack, the lecturer said that, apart from the blockade activities, the first offensive action by naval aircraft was mine-laying off the Skaggerak and Frisian Islands. The Admiralty decided that the best way of laying the mines was by aircraft. Unfortunately, early in 1940 there were not available any R.A.F. aircraft suitable for this purpose. Two squadrons of Swordfish T.S.R. aircraft were accordingly modified for mine-laying. It was then found that when fully loaded they carried sufficient petrol for the outward trip, but had only enough fuel to get them halfway back, so overload tanks were introduced. This means a large petrol tank some 3in. or so square and about 2in. high being mounted on the seat usually occupied by the observer, which then "nestles gently behind the pilot's back, on the one hand, and the observer's neck, on the other. This latter officer by now had been translated to the air gunner's seat, there to work out under conditions of intense discomfort his navigation, the wireless, the rear gun, to carry out reconnaissance, and to do anything else he might have the time or inclination to do."

Swordfish Attack Shipping

The lecturer mentioned the attack by three of the *Eagle's* Swordfish upon enemy shipping at El Gazala (Bomba). These three aircraft armed with torpedoes carried out a night attack on enemy shipping in the harbour. The first one torpedoed a submarine near the entrance, while the other two attacked one on each side of a depot ship with a destroyer lying on one side of it and another submarine on the other. The result was the sinking of four ships with three torpedoes.

The lecturer then referred briefly to various operations in the Mediterranean and the Taranto attack, mentioning that that was only the third operation ever conducted in



A Hurricane catapult fighter on a C.A.M. ship. These fighters now belong to a so-called Merchant Ship Fighter Unit.

war by any carrier entirely at night. The Swordfish took off from the fully darkened carrier (*Illustrious*) and afterwards landed on at night. These Swordfish were also fitted with overload fuel tanks. Going on to discuss the battle at Matapan the lecturer gave as one sidelight on the battle the fact that there was then based on Athens a naval aircraft squadron which had been formed by aircraft which survived the bombing of the *Illustrious*. It had been at work in Greece making night attacks on the Italian ports of Valona, Durazzo and Brindisi, in two months had destroyed some 50,000 tons of enemy shipping and had helped to foil the Italian spring offensive in the Epirus.

Immediately before the battle of Matapan this small squadron commanded by a Lieutenant, R.N., proceeded to Maleme but was based on Athens for torpedo supplies. When it was known that the Italian Fleet was at sea, three aircraft of this squadron made an unsuccessful attack on Italian cruisers in the morning. This was followed by a reconnaissance by a naval Fulmar also in Crete, and as a result of this two aircraft with the remaining two torpedoes took off before dusk to attack the Italian Fleet. They scored at least one hit on the cruiser *Pola* and stopped her. As a result the Italian Admiral kept his cruiser squadron by the stricken ship and finally Admiral Cunningham brought up his heavy ships and dealt with them. The lecturer remarked: "This example of the brilliant command of a squadron (a command which lasted for the best part of a year) by a Naval Lieutenant, is but one of the numerous cases in which such officers have been called upon, in this war, to bear the responsibilities of higher rank without the increased status of an acting rank which is common to the other two Services."

After the fall of Crete, naval Swordfish and Albacores based on Malta have been constantly striking at Axis convoys by night and have often had to operate at distances which left them a margin of only 15 minutes' flying time.

(*Continued on page* 497.)

Hurricanes, Martlets and Albacores on the flying deck of one of the aircraft carriers which accompanied the famous convoy to Malta.

Topics of the Day

A MATTER OF FLEXIBILITY

Sidelights on Constant-speed Airscrew Action : Some Curious but Inevitable Effects : The Virtue of Taking Things for Granted

CERTAINLY the human animal must be the most flexible, morally and physically, in the universe. Otherwise the race would never have survived all the changes that have taken place in its environment and living conditions—changes that have been most marked in the last fifty years. Not only does mankind fill its stomach with all kinds of poisonous rubbish and its lungs with a slightly narcotic smoke, but it also fills its brains with masses of useless material while still leaving lots of space for the more important things.

Whenever people complain of the way in which the ordinary human takes things for granted—from radio and aircraft to the most appalling bangs coupled with sudden death—I feel quite certain that it is this "take-for-grantedness" which the race must thank for its survival, rather than the use of its hands or its poor little brain. In the long-ago days, circumstances would place the little man in tropical or arctic conditions, yet he would manage to survive; nowadays the remarkable fellow deliberately places himself at 30,000ft. and dashes himself down to ground level in a minute or less; he breathes fifty per cent. carbon dioxide and tobacco smoke in a night club, fills himself with hooch, goes to bed at three, gets up at six, applies a successive series of 4 G. loads on himself while breathing a mixture of air, oxygen, and carbon monoxide; he sits, stripped to the waist, in the bowels of the hottest and noisiest piece of machinery that could possibly be devised, while his mind wanders round and round the unpleasant knowledge that a direct hit on his tin-can tank may reduce it and him to a blazing cauldron—and seems to be much the same after these experiences. He probably won't grow old any sooner, either.

C.S. Airscrew Revs

But the price of such extraordinary flexibility is, as I say, this annoying way the race has of taking the most remarkable developments entirely for granted—using, for instance, the wireless telephone to talk about trivialities, and the radio broadcast system to sing banalities. Even the flying machine no longer excites anyone but the small boy—unless it is dropping bombs, and then the excitement is of the wrong kind.

I confess to taking things for granted, with the rest, though I never cease to wonder at the reliability of aircraft, particularly after a moment's ruminative examination of the interior, with its wiring system like a village telephone exchange and its hydraulic system like a plumbers' palace. Somehow, in aircraft and otherwise, we ought to be able to make something to our advantage of the experience which has been gained in the layout when we are finally able to live in peace. At least, our wireless sets shouldn't break down, our electric bells should continue to ring without attention, and our cars shouldn't stop through short-circuits or oil system failure.

Just take one example—a mechanism that is simply accepted—the constant-speed airscrew. It is accepted, yet hardly ten per cent. of the pilots who fly beside, in front of, or behind it understand what is going on. Worse still, though they may understand all the workings of it, not ten per cent. of the ground crews understand what it *does*. So you have two extremes: the pilot who knows what it should do and can't explain or make the adjustment that may be needed, and the groundsman who quite understands all the mechanism, but who cannot understand what the pilot is yammering about.

Since no airscrew has a complete range of constant-speed movement, from a no-progress-at-all fine pitch to the fully feathered position, it is quite normal for a c.s. airscrew to be far from constant-speed during a ground run-up. In other words, though the control setting may be arranged to give, say, 3,050 r.p.m. in theory, the maximum revolutions during a run-up may be anything from 2,700 to 2,800, depending on blade shape and whether the aircraft is heading into a strongish wind or not. If they are accustomed to such a range of figures the ground crew will accept them; but let a particular example give a mere 2,600, and they will rush furiously around with screwdrivers and things, altering the c.s. stop, and will be alarmed to find that the revolutions do not increase. They can't be made to see that, once the c.s. jugglery has wound the blades round to the finest angle available with any particular airscrew, it can do no more, and the airscrew can be treated as one having a fixed pitch. To obtain an increase in revolutions either more power must somehow be obtained from the motor, or the basic blade angle must be decreased.

Screwdriver Wiliness

After the ground crew have done their worst with a screwdriver or what-not, the machine is taken up. They know, from previous experience, that revolutions are always higher in the air, because pilots have told them so; they think that this phenomenon is caused by some special property of aviation as opposed to mere ground running. And they ask, "What did you get on take-off?" The correct answer is, "At what moment during the take-off? When I opened the throttle the figure was 2,600; when I was airborne it was 2,700; when I was doing 120 m.p.h. it was 2,950; and when I reached 160 m.p.h. it was 3,050. There, because the c.s. unit was working and the governor weights were flung out at just the right angle, the needle remained." If, of course, the boys had been too wily with the screwdriver, the needle would try to go off the clock, and that would take a whole lot of further explanation.

I remember one case when an airscrew had previously been changed on a twin and the run-up figures for the engines were 2,475 and 2,650 respectively. The boys had run and run those engines—the correct figure was 2,650—and had finally brought the high figure down to match the low one by adjusting the c.s. stop. The r.p.m. indications looked very nice on the ground, and I was told with wide-eyed innocence that, "of course," I would get the correct figures "on take-off." Knowing what had been done, there was nothing very surprising about the figures actually obtained at all speeds in the air with the c.s. control fully forward—2,650 and 2,475 respectively. The port airscrew had duly caught up on itself with increased speed, and the starboard airscrew revolutions, of course, remained just where they had been set on the ground.

Range of Blade

As I've no doubt remarked before, a constant-speed airscrew is what its name implies—a device to keep the engine revolutions at a constant, though adjustable, figure. The perfect example would give the same figures on the ground and in the air (and some of them do), but the action is necessarily limited by the actual range of blade movement. In full fine and with an engine giving, say, 1,200 b.h.p., the revolutions will be, say, 2,750 on the ground; give the airscrew a bigger range of travel, or produce more power, and the revolutions will go up to, but not beyond, the controlled figure; the c.s. control has done all it can until this particular aircraft is in the air and the airscrew is working in more natural conditions.

Not one word of which must be taken as being technically above reproach, but I'm hoping that both the technicians and the pilots will see what I'm driving at. In

A MATTER OF FLEXIBILITY

fact, I haven't really got much of an idea of what goes on inside the box of tricks, but I understand the principle of the thing, how it works "in simple language," and what it should do in actual fact. I'm complaining not about the simple people who are content to let it happen and prefer not to know very much, but about the minor self-credited experts who know it all and cannot, therefore, be made to see what actually happens in the air.

"Indicator's" Indicator

The constant-speed airscrew has lost us the good old-fashioned indications of brewing trouble. And there again it is extraordinarily difficult to make the groundsman see that, with a c.-s. airscrew, these indicating things remain very much the same even after a complete engine failure. In earlier days, before the development of the automatic mixture control, the introduction of the c.-s. airscrew meant that devices such as exhaust analysers had to be used to make a correct mixture-setting possible. With fixed, or two-position, or variable-pitch airscrews, the over-leaning of the mixture showed an immediate drop in revolutions. The c.s. airscrew removes that guide (though there will always be a momentary drop before the airscrew can do its work) and only after the cylinder-head temperatures have gone up will it be realised that the adjustment has been overdone.

Anybody who has suffered an engine cut, through fuel failure or other non-mechanical trouble, on a twin-engined machine knows that the failure is only immediately recognised because rudder has to be held against the dead engine. The airscrew, after a momentary lag, holds up the revolutions to the best of its ability and the boost, if it is anywhere near zero, remains more or less the same. On some four-engined types one of the two inner motors can, in fact, fade out quite a long time before the fact is noticed. A little rudder has to be held, but the correction is instinctive and is noticed after a few minutes only because of the inevitable ache in the leg. The boost and revolutions remain more or less the same; the noise, if appreciable, doesn't alter if the other three engines are in phase; the oil and even the fuel pressure may stay put; but the head temperature goes down quite surprisingly quickly and this may, in fact, be the very first indication of trouble.

I remember a case in which the two inners in an American four-engined type were accidentally stopped on the cut-outs, and remained stopped until the pilot noticed that the speed was falling off and the head temperatures were going back to zero. British machines usually have the carburettor cut-outs either separately placed or connected to the main fuel cocks, and in any case, I believe, their action will not stop the engine at anything but small throttle openings. American cut-outs are merely a continuation of the movement of the mixture controls and, if these are moved too far, the engines either stop or are running in such a weak state that they are virtually dead.

One of the advantages of the electrically operated airscrew is that each master control switch—as opposed to the c.s. control levers or switches—has a neutral position, which leaves the airscrew in a fixed pitch. Apart from the saving of undue wear in the operating motor this leaves the airscrew in its good old-fashioned fault-showing form. For both reasons it might be a good idea to incorporate some kind of control in the oil-pressure system so that even the hydraulic types can be "fixed" at will. Maybe such a fitting is technically impossible, but it seems to be worth thinking about in future designs. "INDICATOR."

WAR RECORD of the FLEET AIR ARM (*Concluded from page 495*)

The lecturer then mentioned naval squadrons operating with Coastal Command. Early in the war these squadrons based on the Orkneys undertook many operations against enemy shipping off Norway. Outstanding among these was the attack by Skua dive-bombers which resulted in the sinking of the German cruiser *Königsberg* in April, 1940. The lecturer added: "The aircraft taking part in this operation flew for three hours over the sea, carried out an attack on a powerfully armed warship in harbour, and then flew for three hours back again, when the official endurance of their aircraft was only some 5¾ hours."

The lecturer then turned to the third duty of the Navy in war, namely, co-operation with the other Services. The first example of this was the Norwegian campaign. He ran briefly through the operations of the carriers in this campaign, mentioning the loss of the *Glorious* by surface attack and added: "It was in this campaign that the ubiquitous Swordfish came in for two new roles, ones for which, even the sternest critic must admit, they were unsuited. First, that of day dive-bomber without fighter escort, and again that of flying in formation at their maximum altitude and pretending to be fighters."

During Dunkirk one squadron of Swordfish was used to carry out day dive-bombing attacks on enemy troops in the Calais area. This squadron lasted for six days, carrying out two sorties a day and on two occasions operating in formation as a fighter patrol. By that time it had lost half its effectives.

The lecturer referred briefly to the operations at Dakar and said that from the lessons learned there the subsequent operations at Madagascar had been planned and executed with great success. British naval aircraft provided an anti-submarine screen round the convoy in its early stages, an air umbrella during the landing of the troops, and bombing and ground-strafing attacks on military objectives during later operations. Two submarines, one armed merchant cruiser and one sloop were accounted for. He also paid a tribute to the all-round useful work of the cruiser-borne aircraft operating on the trade routes.

He then said: "In conclusion the following figures give some small indication of the achievements of naval aircraft so far. (a) During the war naval torpedo aircraft have accounted for over 30 warships of all types and over 410,000 tons of enemy shipping sunk or damaged. (b) When operating with Coastal Command (1940-41) naval aircraft made over 58 night dive-bombing raids on the enemy-occupied Channel invasion ports, also on Brest and Lorient. (c) In the Mediterranean (1940-41) over 60 similar raids were made on enemy ports, airfields, etc., in Italy, Sicily, Sardinia, Tripoli, Syria, Dodecanese, etc. They also made the first night raid on Italy when they attacked Genoa on June 14th, 1940. (d) Although details of anti-submarine warfare cannot be given, naval aircraft have contributed a full share throughout the war, although carriers have not been directly re-employed as in 1939.

"There, gentlemen, is the story of the Fleet Air Arm. The losses have been heavy in ships, men and aircraft, but it is noteworthy that only one carrier out of five has been lost by air attack. On the other hand, the results which I have endeavoured to show to you to-day have been considerable, so considerable that I think they justify two final premises.

"First, that the vital operational potentialities of naval aircraft flying at sea, whether shore- or carrier-based, will repay the keenest study of all officers, both senior and junior, of the three fighting Services, and second, that these same achievements justify the granting of the highest *priority* to the Naval Air Service in their choice of personnel—their shore-based training facilities and the design and production of faster and more heavily armed aircraft to support from the air 'The Navy, upon which, under the good providence of God, the wealth, safety and strength of the Kingdom do chiefly depend.'"

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Italy Jumps

THE Fascist Youth Organisation of Italy (*Gioventu Italiana del Littorio G.I.L.*), which enlists members up to 20 years of age, is now organising special camps and courses for the training of parachutists. Upon completion of a course, members of the organisation are awarded an official badge and are to form 'the future reserve cadres for Italian paratroops.

Mobile Workshops

THE Turin newspaper *La Stampa* reports that a special workshop train for the Italian Expeditionary Force has been constructed by the Fiat company. The object of this mobile workshop is to give the maximum of assistance to the Italian forces employed on the Russian Front, particularly the *Regia Aeronautica*. The train consists of 40 railway trucks, and a staff of 65 is attached to it.

The Italian source reports further that numerous repairs have been carried out for the *Regia* operating in the Southern Sector of the Russian Front. Supplementing this by information from Russia about the misadventures of the Italians, one can well imagine that these mobile workshops are working overtime.

Hungarian Accident

A BUECKER-JUNGMAN, one of the most advertised German training aircraft, piloted by the well-known Hungarian instructor, Kasnadi, went into a spin following a number of aerobatic manœuvres and crashed into the Danube. Count Julius Karolyi, President of the Hungarian Aero Club, and son-in-law of the Regent, who was on board, was killed. Count Karolyi was 36 years of age, and became President of the Hungarian Aero Club after his brother-in-law, Stephen Horthy, was killed while flying with the Hungarian Air Force last August.

Petrol from Peat

PEAT, which in past years had only a limited economic significance, is gradually becoming a strategic material. The Russians were the first to realise its dormant possibilities. In 1938 they made a careful study of their peat resources, estimated to amount to 150,000,000 tons. The Germans have recently established a new company, the *Deutsche Torf-Gesellschaft G.m.b.H.* (German Peat Company) with the object of exploiting the peat resources in Eastern Europe.

It is estimated that 2.4 kg. of peat have the same calorific value as 1 kg. of coal, and that from 2.3 kg. peat 1 kw/hr. of electric current can be obtained. Researches have also shown that peat oil contains motor fuel from which high-grade aviation fuel can be produced. In addition, other valuable materials, such as Phenol (the basic material for bakelite) Vasenol, etc., can be obtained from peat.

In Sweden three plants are already engaged on the manufacture of peat-coke, and fuels; in Denmark, Spain and Italy similar development is reported to be taking place. Incidentally, peat-coke is increasingly used as fuel for motor vehicles, since the type of generator necessary is cheaper and simple to manufacture.

Air Defence Boss

GENERAL FRIEDRICH HIRSCHAUER, G.O.C. of the *Luftgau* (Air Zone) XVII (H.Q. at Vienna) has been appointed by the Fuehrer to be President of the Reich Air Defence League. He retains his H.Q. at Vienna, and his successor as G.O.C. of the *Luftgau* is presumably General der Flieger Bogatsch. The Air Defence League is the official body responsible for all A.R.P. measures in Germany. The anti-aircraft artillery section is under General Guenther Ruedel, Chief of the Air Defence Department at the German Air Ministry.

General Hirschauer, a 59-year-old Rhinelander, served during the last war in the artillery and was later taken over by the newly created *Reichswehr*. Since the creation of the *Luftwaffe* he has been senior O.C. flak artillery at Koenigsberg and Dresden, and was later charged with the organisation and the command of *Luftgau* XVII.

German Curiosity

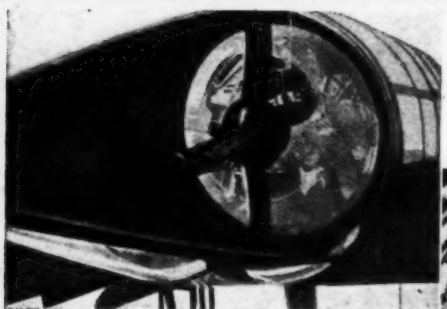
THE *Berliner Illustrierte Zeitung*, a leading German periodical, devotes two full pages to pictures of crashed or captured remnants of British and American aircraft. The Germans are apparently delirious with joy over finally having obtained a Spitfire undercarriage, an American hollow airscrew and a Wellington. Pictures are shown of experts busy on methodical examinations with magnifying glasses, special cameras, etc.

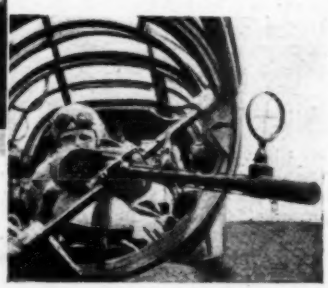
The rear gunner's turret of a Wellington is a special attraction, and it is said, with glee, that "It will be of special interest to the *Luftwaffe* engineers." And this after three years of war!

"Luftwaffe" Officers

TO replenish the cadres of officers, new regulations governing the appointment of candidates for the career of officer have been issued by the German High Command. School leaving certificates will not be required. The only requirements are devotion to National Socialist Germany, and its Fuehrer, military merit, enthusiasm for a military career, outstanding leadership quality, intelligence, physical fitness and Aryan blood.

IN THE ROUGH STUFF: A Focke-Wulf Fw 198 flying near the peak of Mt. Elbrus (18,471ft.) in the Caucasian mountains. Weather conditions in this area are particularly bad in the winter, and emergency landing grounds scarce.





Two versions of the tail-gun position on the Focke-Wulf Fw 198. (Above) A twin machine-gun and (right) a single gun on a different mounting. The Focke-Wulf Fw 198 is the *Luftwaffe's* general-purpose aircraft, employed on the Russian front on reconnaissance work.

LISBON'S NEW AIRPORT

Now in Use Though Not Quite Completed : British Airways' Machine Effects "Symbolic" Opening : Air-marine Base Also Projected

LISBON Airport has at long last become a fact, for as from October 19th it can now be used by aircraft. Although not yet quite complete as regards the buildings, the airfield and runways are quite ready. Because of the insufficiency of the Sintra airdrome, and the difficulty of access to Sintra, the new Lisbon Airport has been thrown open for service. It has not yet been officially opened ; this ceremony will only take place when all the buildings are finished and the radio installation, ordered in the U.S.A., has been installed.

The new airport was "symbolically" inaugurated on October 15th, when an aircraft of British Overseas Airways (of American construction and the property of a Dutch airline company) flew over the city and landed on the new airfield with a load of distinguished passengers, namely, His Excellency the British Minister to Portugal, Mr. John Balfour ; Col. Alfredo Sintra, Commander-in-Chief of the Portuguese Military Air Force ; Engineer Rodrigues de Carvalho, President of the Lisbon Municipal Chamber ; Mr. L. E. Hough and Dr. Alexandre Pinto Basto, of British Airways.

Representatives of *Lufthansa* and *Ala Littoria* were also present at the airport—representing "symbolically" their respective nations.

Position and Approach

Although no longer a secret, it is not yet possible to publish details as to the size, length and number of runways, and other interesting facts ; these should be available shortly. But one can state that the airfield is quite large, even although not so large as others one has seen in Europe. It is very well situated, but a few miles from the centre of Lisbon, easily reached in ten or twelve minutes by car or motor-coach.

It stands on a small plateau to the North of Lisbon, just beyond the administrative boundary of the capital, and the approaches from all directions are as near perfect as can be. The nearest obstacle which might offer danger in bad weather is found in the wireless masts at Monsanto, but they are several miles away and in a direction not likely to be used except in emergency. The municipal authorities have provided a broad avenue from the centre of the city to the outskirts (Arieiro), whence the avenue becomes even broader, with two wide traffic ways separated by a grass plot, all the way to the airport buildings. Each traffic way can comfortably accommodate at least four automobiles abreast, and it is almost as straight as the proverbial die.

The new airport is quite near the air-marine base of Cabo Ruivo, say five or six minutes by car, which is a favourable feature.

The management of the airport will be taken over, for the time being, by an Administrative Commission, composed of aeronautical, military and civilian technicians. It is intended that, eventually, the management of this airport, as well as any others that may be established in the future, shall be taken over by a concessionary company, which will probably imply rather less control by the State, although it is likely that the State will always be in the background. No details of the nature of this concessionary company are available for the present.

Cabo Ruivo

Cabo Ruivo base, started by Pan American Airways early in 1939, has never been more than a provisional one. The facilities had to be improvised, and P.A.A. had to make the best of the site offered—there being few others suitable, and none offering everything that could be desired. Perhaps the most awkward feature of the base, as it exists, is the fact that it is not easy of access from Lisbon, and although not far, the road runs through a somewhat congested and fairly industrial part of the town.

However, authority has been given by the Portuguese Government, through the Ministry of Public Works, for the construction of a proper air-marine base, on the same site, and, having regard to the requirements of such a base, attention will be paid to the river bank, as well as to the industrial area which it is expected will grow up in the vicinity.

Projects exist for this work, although no details have been released yet, and a large sum of money has been allocated to begin the scheme.

Lisbon will therefore soon become marked in very large letters on the commercial aviation map of Europe, because geographically it is undoubtedly the most suitable junction between the Old and New Worlds, irrespective of Old or New Orders, and when peace comes to us again the importance of Lisbon may return to something of what it was 200 years ago, when it was the clearing house of South-Western European trade with the Americas and Africa.

COMPOSITE NON-SUCH—No. 2

Here is a twin-engined bomber of very mixed parentage for a spotters' exercise. While it looks reasonably normal, we should hate to handle it round about the stall. The parts to be identified are : (1) Port wing ; (2) port engine ; (3) port undercarriage ; (4) starboard wing ; (5) starboard engine ; (6) starboard undercarriage ; (7) nose ; (8) under turret ; (9) rear fuselage ; (10) port tail assembly ; (11) starboard tail assembly.

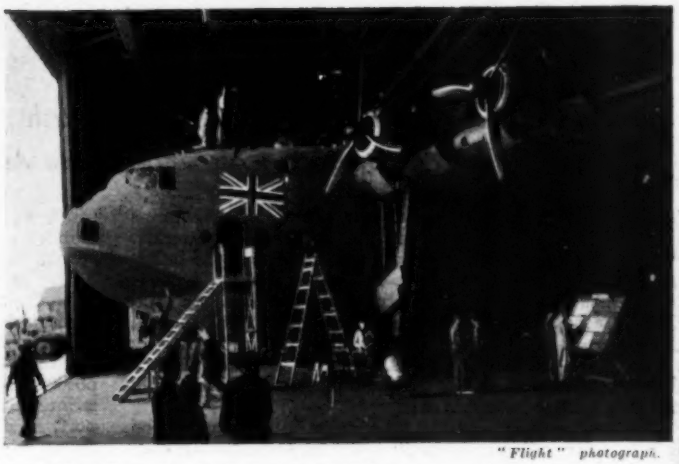
(*The solution appears on page* 508)

B.O.A. MAINTENANCE

A Marine Base of British Overseas Airways

A ROAR of engines overhead; eyes are turned to the sky above, and through the mist and haze a British merchantship of the air, a few moments later, makes a perfect touch down on the water.

The giant "G" class flying boat of the S26 type, designed and constructed by the famous firm of Short Bros., Ltd., eventually comes to rest and then begins to manœuvre towards the slipway. This particular marine base of the Corporation in the U.K. is where the flying boats are groomed for their journeys of many thousands of miles along the essential lines of communications of the United Nations' war effort, involving non-stop flights of over 1,900 miles.



"Flight" photograph.

Golden Horn, one of the 73,000 lb. Short boats, undergoing overhaul.

Inspectors, engineers and mechanics are ready while beaching trolleys and tractors get into position, and a few minutes later the *Golden Horn* is at the slipway. As the crew comes ashore the Captain is met at the head of the slipway by Mr. G. J. Bryan, Assistant Service Engineer of the station, and the technical log is handed over. This is a comprehensive document in which all information relevant to the mechanical condition and performance of the aircraft and its engines is recorded at regular intervals during flight. It also includes copies of routine sheets, details of any adjustments made, and items of maintenance work undertaken at stations overseas on the past journey. Thus the base personnel are at once aware of the mechanical history of the aircraft from the day it left their care after its previous overhaul. The inspectors have already gone aboard to begin the preliminary examination of the aircraft whilst it is being beached.

Teamwork

During the beaching operations we are joined by Mr. J. H. Robson, the Service Engineering Director of B.O.A., and one is immediately struck with his tremendous enthusiasm and the great respect he holds for all those under his direction who, under the greatest difficulties, enable this organisation to function with such success. Watching with a critical eye these engineers and mechanics getting to work, one readily appreciates that Mr. Robson has here a magnificent example of perfect teamwork, understanding and efficiency throughout the staff.

Some fifteen minutes later the boat has been towed into the hangar and, as it passes, one is impressed with its overall size, for it weighs approximately 33 tons fully loaded, and carries 3,470 gallons of fuel. The realisation of air-travel in the post-war era with boats of even larger sizes becomes uppermost in one's mind. On entering the hangar we notice that, already, maintenance routine sheets and inspectors' reports have been put up on a board conveniently accessible to all staff, thus enabling supervisors to allocate to the appropriate specialists items of rectification called for by inspectors over and above the routine items of work which are regularly undertaken at the end of a prescribed period of flying.

Accessories that have completed their prescribed period of service are removed and sent to the appropriate section for overhaul. This procedure is adopted in the case of engines, airscrews, radio installation, instruments, hydraulic apparatus, electrical accessories, engine installation details and upholstery.

For many years it has been the practice to stagger the items of major overhaul work so that each item can be attended to conveniently during "turn round" periods. This eliminates the necessity of laying up the aircraft for a month or more during each year.

During *Flight's* visit, Mr. J. H. Robson disclosed some of the problems of his department during the war. The department's duty is the maintenance of the Corporation's fleet in an airworthy condition. Normally, this work could be carried out at one or two main bases and the engineers would not, at the most, have more than two or three types of aircraft with which to deal.

Due to the war, this routine no longer exists; maintenance bases have had to be dispersed to many stations on the routes, and when one considers these routes extend from just south of the Arctic Circle to Durban, and from the U.S.A. to Calcutta, the magnitude of the task begins to become apparent.

The urgent requirements of the R.A.F. and our Allies for fighter and bomber aircraft have prevented British Airways from acquiring the necessary replacement aircraft. Instead of achieving the maximum possible degree of standardisation, these circumstances have resulted in the exact reverse and peacetime standards have had to be dispensed with. Solving the problem has resulted in a comprehensive system of staff training and world-wide dissemination of technical data.

Dispersed Bases

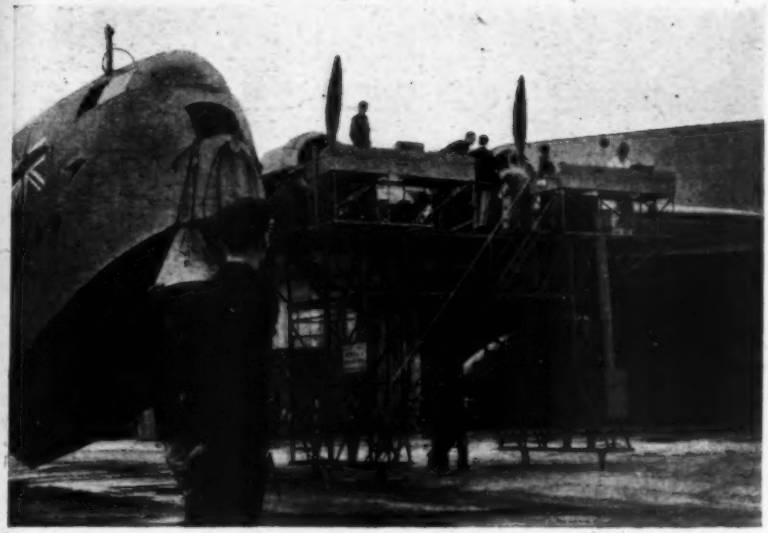
It has also meant the provision, at the numerous maintenance and overhaul bases, of appropriate stocks of over 50,000 different kinds of spare parts, which themselves have to be obtained from various manufacturers and very often delivered by air to the bases. Modern aircraft require highly specialised tools and equipment, mostly peculiar to one type of aircraft, and it is only with these tools that aircraft can receive the expert and regular attention necessary for efficient operation.

Lastly, the exigencies of wartime operations frequently require transfer at short notice of aircraft from one route to another, and, as the technique of servicing varies according to climatic conditions and involves considerable modification to the aircraft concerned, another burden is added.

With all these difficulties, however, the regularity of the flying boat services proves the sterling quality of British aircraft, engines and accessories, and reflects the greatest credit on the specialised staff of men and women whose duty it is to maintained the flying boats in serviceable condition. Dispersed at 101 stations in different parts of the world (53 being landplane stations and 48 flying boat stations, 21 of which are able to cope with both types), they are making a magnificent contribution to the war effort of the United Nations.

The supply of spare parts for aircraft engines at one time presented a serious problem, owing to the enormous quantities demanded by the R.A.F., and it should be borne in mind that, although British Airways are entrusted with the lives of the most distinguished leaders of the United Nations, the requirements of the services must come first.

The Service Engineering Director, however, hit on a most enterprising scheme to get over this difficulty. A factory was acquired in the United Kingdom, and arrangements made with the M.A.P. that suitable engines which could be salvaged from the Services from crashed or damaged aircraft were collected by the road transport organisation of B.O.A. and brought to this factory. Here these battered aircraft engines were dumped in the yard of the newly acquired factory to be eventually broken up. Under the critical eye of skilled inspectors, some parts were found to be still serviceable. These parts were dismantled, cleaned and carefully checked, whilst the remainder were broken up for scrap. By this means an enormous amount of spare engine parts were obtained eventually in excess of B.O.A. requirements, and there are



"Flight" photograph.

British Overseas Airways have designed a rostrum for attending to engines. One is seen here in use with the Short boat *Champion*.

now occasions when B.O.A. can supply spares to the manufacturers from this source when urgency demands.

With the Assistant Service Engineer, Mr. G. J. Bryan, we began a tour of the base, starting at the engine bay where the Bristol Hercules and Pegasus engines are received from the engine overhaul depot and built up as complete power eggs ready for installation in the aircraft nacelles. About 25 hours are required for this build-up, but owing to standardisation of power plants complete with cowling and mountings, the changing of engines in the aircraft is a comparatively easy and quick job.

Following on to the unit shop, where all units removed from aircraft and engines are overhauled and made ready for refitting, one was struck with the ingenious rigs available to cover all tests required to be carried out. These are mostly designed and constructed by the engineers of the department; in fact, throughout the base, the time and money-saving devices produced by the department are a distinct revelation deserving the greatest credit.

Entering the stores, which unfortunately was only about half the size necessary for the work entailed at this base, the efficient layout method and organisation was already evident when the chief storeman himself explained just how he obtained "one gallon in this pint pot" and yet, as could be seen from the tabs and bins, had anything and everything available and within easy reach, and was still able to maintain a clear passage way on both floors.

C. of A. Routine

The inspection department was a revelation, with its wall of charts of various colours which at first glance were baffling to even one frequently accustomed to this procedure. Mr. Bryan left it to the inspector in charge to enlighten us on the procedure of his department and to explain the mystic charts of many colours. The technical log carried by each aircraft was explained in detail, for it is this document with which the inspection department is primarily interested in connection with the subsequent overhaul.

From the numerous charts it eventually became obvious that here, at a glance, could be told the exact amount of work carried out on the various flying boats in the service of the Corporation, the position of work already in hand, when the "C. of A." was due for renewal, and many other details.

After the work called for in the inspection reports and routine sheets has been completed to the satisfaction of the specialist supervisors, the inspection staff carry out a final examination to ensure each item has been completed in accordance with the standards laid down. The specialists who carry out the work, their supervisors and inspectors, are all required to sign against each item, thus establishing beyond all doubt the responsibility for the satisfactory completion of the job.

The tour concluded with a visit to the instrument shop where all instruments used on the aircraft are checked, followed by the airscrew overhaul shop with equipment for balancing and minor overhauls to airscrews, the component shop, and finally the main hangar. In this building were various types of aircraft in the B.O.A. service, including "G" class, "C" class, and American "Catalina" flying boats.

In a few days the "G" class boat will be once again withdrawn from the hangar and the engines, controls, instruments, and equipment given a thorough ground test. The boat will then be launched and a test flight made to ensure the mechanical behaviour of the aircraft is satisfactory. The signed copies of the routine sheets and inspection reports will then be centralised in the office of the inspector in charge, where the "aircraft prepared for service" form will be completed. This document will advise the traffic and operations department of the tare weight of the aircraft, so that fuel and oil requirements and pay load may be regulated.

During maintenance, additions and alterations sometimes have to be made to the structure and equipment of the aircraft, involving alterations in its tare weight. It is thus very necessary for a careful check to be maintained so that the maximum permissible weight is not exceeded and valuable pay load is not lost. Thus the aircraft is once again ready for operation, "certified airworthy" by qualified ground engineers.

Once again it will be on its way across the Atlantic or to some other corner of the Empire, maintaining the lines of communication of the United Nations.

"Flight" photograph.

Reassembling a de Havilland c.p. airscrew hub in the airscrew department.

Three-a-Night Pilot is Ex-Motor Cyclist

BY shooting down three enemy bombers at night recently Flying Officer George Pepper, D.F.C., becomes the second night fighter pilot to accomplish this feat in a single night over Britain.

The first was Wing Commander John Cunningham, who bagged three Heinkel lll's in April last year. Flight Lieutenant Kuttelwascher, the famous Czech night fighter, shot down three German bombers on intruder patrol over Northern France on the night of May 4 this year.

Flying Officer Pepper, who is 26, is a former T.T. motor cyclist and dirt-track rider. He rode for West Ham, and at one time captained the Newcastle dirt-track team.

His home is at Belleville, Ontario. He won the motor cycle road racing championship of Canada in 1936; joined the R.A.F. in 1940; and has now been a night flyer for almost a year. He and his Flight Commander, who holds the D.S.O., D.F.C., and Bar, have together destroyed 18 German bombers.

GUN-TURRET OPERATION

Details of Parnall Hydraulic System : The Multi-vane Oil Motor

ABOUT ten years ago the curve of progress towards greater speeds took a sharper trend, so that all problems relating to drag took on an ever-increasing importance.

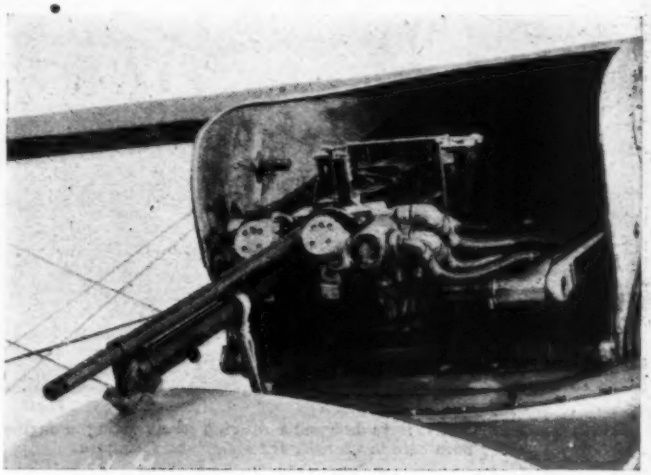
Captain A. Frazer-Nash and Captain E. G. Thompson realised that the time had arrived when the manual operation of turrets was beyond the capacity of even a strong man, and accuracy of aim was becoming quite unattainable.

In the far-off, when the Scarff ring was introduced, the turret torque, with the gun abeam, was already enough to harass the gunner. Increased speeds soon brought this figure up to 180-200 lb./ft., with the immediate prospect of a still greater figure

It was therefore decided to prepare designs for a power-operated turret in order that the requisite power and accuracy of fire could be obtained under modern flying conditions. The turret design was first submitted as an isometric view which, next to a mock-up, showed most clearly the general features and layout, and served to awaken the interest of the authorities.

The successive stages of negotiation with the Air Ministry, the various personalities and the parts they played in bringing this development to its present-day success, have already been published (*Flight*, February 22, 1940), but of necessity it has been impossible to say very much about mechanical details. After consideration of the various systems available, it was decided to employ hydraulics.

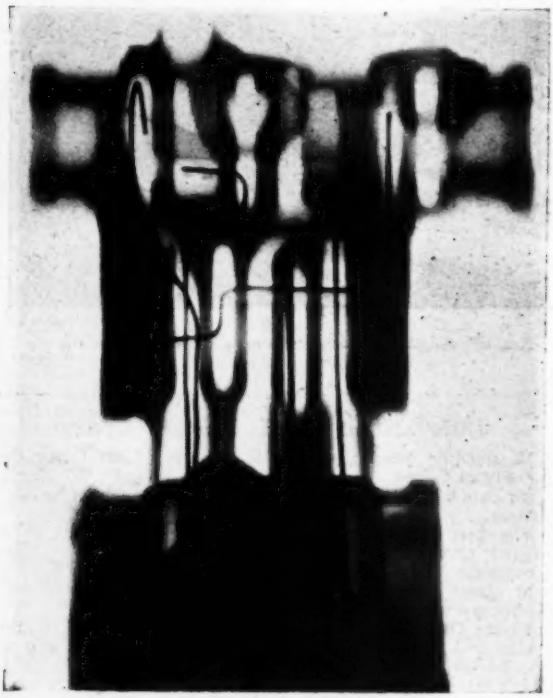
It was adopted as a basic principle from the outset that under the conditions of aerial gunnery, with its physical and mental strain, and with the high speeds of reaction necessary, finesse in the control of turret movements was of outstanding importance.



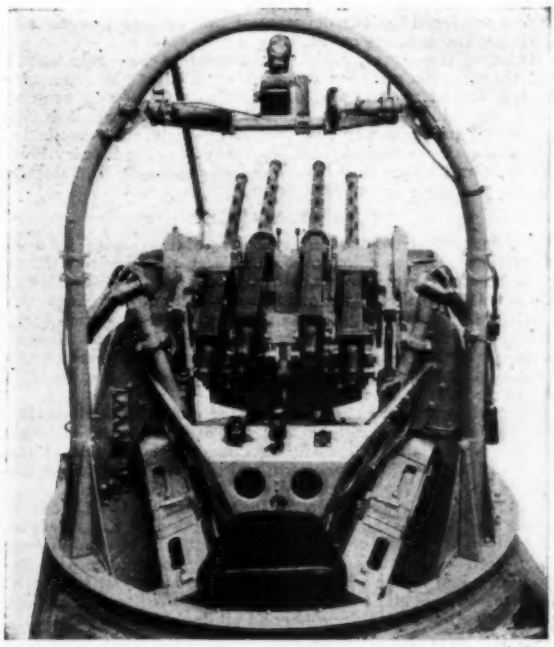
One of the first Parnall power-operated gun turrets with lobster-back construction of cowl. It was fitted to Hawker Demons.

Here, hydraulics lend themselves to sensitive action, and it was found possible to adopt a "natural" form of control which was almost instinctive. This is so accurate that it is customary to demonstrate the turret action on the ground by putting a pencil on the end of the gun and writing with it!

The hydraulic details are full of interest. The elevation of the guns, being limited in extent, permits the use of



Radiograph of an early Parnall design of valve box, showing ports. The wires are in the core, not removed before exposure.

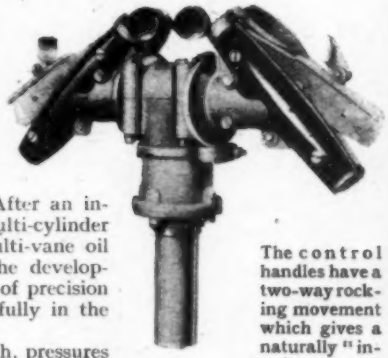


The four-gun turret designed for the Short Sunderland. The cupola has been removed in order the better to show the layout of the turret.

GUN-TURRET OPERATION

simple hydraulic rams, but for the traversing it is essential that the turret should be unlimited as to rotation, and, therefore, a rotary motor is necessary.

For this hydraulic motor the first design comprised a type rather similar to a gear-type oil pump, but leakage at low speeds showed its inherent weakness. After an investigation which covered multi-cylinder plunger and other types, the multi-vane oil motor was decided upon, and the development of this to the present stage of precision is a story which cannot be told fully in the present circumstances.



The control handles have a two-way rocking movement which gives a naturally "instinctive" action.

Turret cupola under loading test.

In a vane-pump the speed is high, pressures are generally low, and inter-cell leakage is of little importance. The stator has generally a plain eccentric bore, and the vanes are spring-loaded to take up the discrepancies of the changing "diameter" on which the vanes operate. In this vane-type oil motor, pressures are fairly high, the speed at times may be very low and none of the comparative crudities of the pump is permissible.

Owing to the degree of pressure employed, it is very desirable that the vanes should not have to slide during the pressure stroke. To satisfy this condition, the vane tips have to move on an arc concentric with the rotor spindle during the working stroke. This then becomes entangled with another consideration: spring loading is out of the question in case a vane should stick, for at low speeds where accuracy is of utmost importance, there is none of the helpful centrifugal force that is to be found in the high-speed pump.

In order to control the sliding of the vanes, therefore, the in-sliding vane is used to actuate the out-sliding vane by means of light tappet rods which, staggered for the three pairs of vanes, pass diametrically through the rotor.

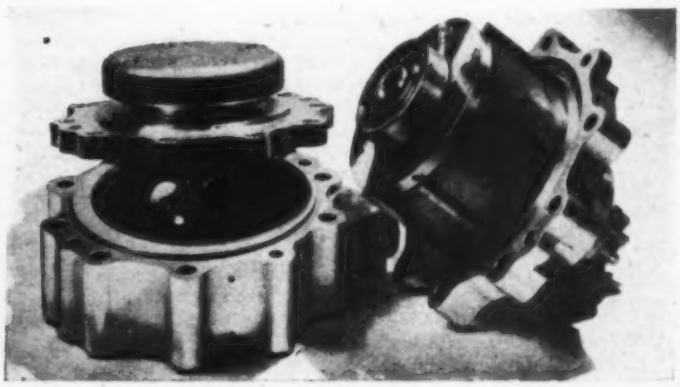
This feature therefore controls the internal profile of the stator: first, there is the concentric arc of the working stroke, and diametrically opposite that is a concentric arc of shorter radius, as demanded by the constant-diameter consideration. These two arcs are joined by what—developed on a straight-line basis—is a serpentine curve, and here again extreme accuracy is necessary in grinding the cam-profile of the stator-bore because, on the constant-diameter basis, one-half of the cam-ramp must be complementary to the other.

The cam-profile is, therefore, obviously of basic importance, and as soon as the design was stabilised, Parnalls designed and built their own boring and grinding machines, which deal very effectively with the stator bore. An interesting feature is the oscillation of the work-carrying head instead of the grinding head, so that the latter—with a wheel running at very high speed—has the utmost rigidity.

Certain details, such as the shaping of the blade-tips in order to obtain the best seal under line-contact conditions, needed a good deal of tedious experiment. So did the hydraulic balancing of the blades, but eventually the design was so stabilised for production that practically no modifications have been necessary despite the heavier duties put upon it from time to time. For instance, turret torques at the outbreak of war were already twice the 1932 figures; present-day figures cannot be quoted. As an indication of the flexibility of its performance, the vane oil-motor gives accurate and smooth action over a speed range of 0 to 1,000 r.p.m.

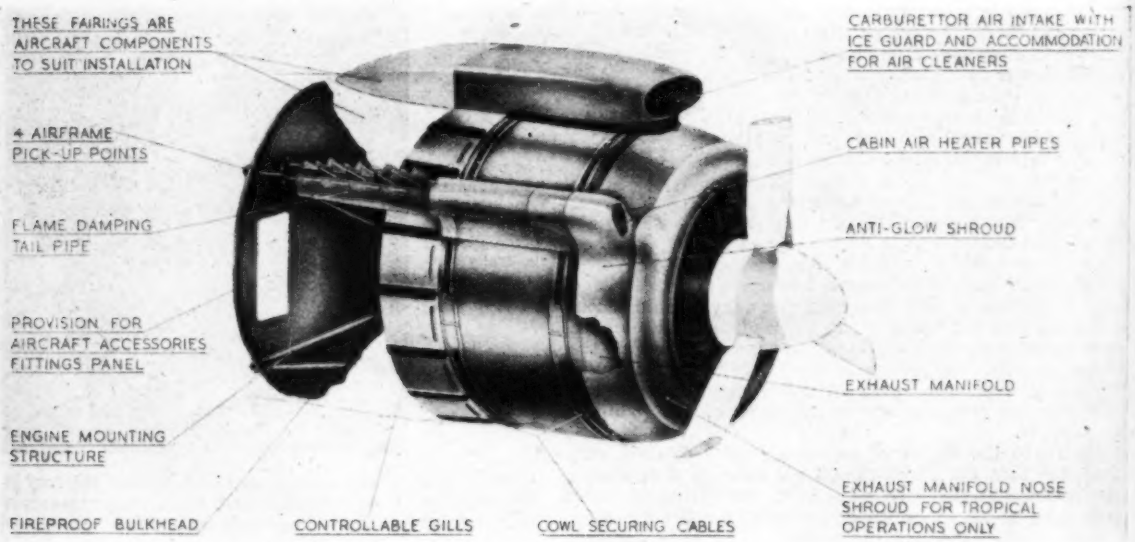
Without modification the present unit has given satisfaction at pressures up to 1,500 lb. per sq. in.

(Left) The special gear-milling machine designed and made by Parnalls for cutting turret gear-rings.
(Right) The six-vane oil motor, developed expressly by Parnalls for their power-operated gun turrets.



THE HERCULES POWER PLANT

Advantages and Details of the Bristol Standardised Mounting Unit


THESE FAIRINGS ARE AIRCRAFT COMPONENTS TO SUIT INSTALLATION
4 AIRFRAME PICK-UP POINTS
FLAME DAMPING TAIL PIPE
PROVISION FOR AIRCRAFT ACCESSORIES FITTINGS PANEL
ENGINE MOUNTING STRUCTURE
FIREPROOF BULKHEAD
CONTROLLABLE GILLS
COWL SECURING CABLES
CARBURETTOR AIR INTAKE WITH ICE GUARD AND ACCOMMODATION FOR AIR CLEANERS
CABIN AIR HEATER PIPES
ANTI-GLOW SHROUD
EXHAUST MANIFOLD
EXHAUST MANIFOLD NOSE SHROUD FOR TROPICAL OPERATIONS ONLY

THE scheme for standardised power-plants was evolved by British airframe and aircraft engine manufacturers with a double purpose: to facilitate the installation of the engines in the airframe; and to minimise the lengths of the periods during which an aircraft is out of service as a result of engine overhaul or repair. The Bristol Aeroplane Company's engineers claim to have pioneered the scheme; but since the Hercules standard power plant was first exhibited at the 1938 Paris Salon, certain changes in the external appearance have taken place due to advances in cowling and cooling technique and the additional requirements of present-day air warfare. The accompanying illustrations show the present standard unit adopted for such aircraft as the Stirling and Lancaster. It is supplied as a basic unit suitable for any aircraft fitted with Bristol engines, and the airframe constructor fits the necessary aircraft services to suit his requirements.

THE advantages accruing from the standardisation of power plants and their mountings, which facilitate quick interchangeability, have already been referred to in these columns. An article in "Flight" of Sept. 24th dealt with the liquid-cooled engine position. The present notes refer primarily to the Bristol Hercules standardised power plant.

Interchangeability

Design, layout, and construction of this standard unit facilitate, as far as possible, both the first assembly in the aircraft and the replacement of units under service conditions. Incorporated in the unit is the conventional engine mounting structure, which terminates at a fireproof bulkhead in four jig-located points designed for simple and easy attachment to the airframe.

Rigidly supported on the engine mounting structure, forward of the pick-up points, is the circular fireproof bulkhead, so that the complete unit can be slung into position, the attachment bolts fitted and all connections expeditiously made. The provision of multiple-point plugs and sockets for all electrical connections is an outstanding advantage in speeding-up operations.

The mounting structure is arranged to give accessibility to the rear of the engine, carburettor, magnetos, etc. To meet the occasions when it may not be necessary to change the complete power plant, provision has been made for the engine to be detached from the mounting structure.

Grouped on the fireproof bulkhead are the engine controls, fuel and oil pipe connections, electrical connections, and also the pyrometer and fire-extinguisher connections. Provision is also made for the airframe constructor to mount the engine-driven Bristol Accessory Gear Boxes, which provide mountings and drives of various speeds for up to six accessories to suit various combinations of the electrical, hydraulic and pneumatic equipment required on modern aircraft; this also includes airscrew-operating systems. As the combinations of these hydraulic and pneumatic accessories may vary with the type of aircraft and the engine station, the connections are grouped on a panel and standardised to an Air Ministry gauge, provision being made to cover all actual or probable combinations of service. This standardised panel, which is an airframe supply, is a detachable fitting closing the opening provided in the bulkhead for its reception.

Provision is made for complete shrouding of the exhaust system to meet the requirements of aircraft engaged in night operations, and the flame-damping tail pipe is arranged to provide a supply of heated fresh air ample for direct cabin heating.

A specialist staff deals with the design and development of these power plants, with related details of cowling, exhaust system, air intakes, etc., and their manufacture is on an entirely independent basis with a capacity to meet all demands for any type of aircraft.

Standard Layout

The Hercules power-plant consists of an engine mounting ring suited to the series of engine incorporated; engine mounting tubes which are attached to the airframe pick-up points; and a bulkhead to which all engine and accessory services are led. All connections on this bulkhead are disposed according to a standard layout, and the

THE HERCULES POWER PLANT

airframe pick-up points, which are only four in number, are also spaced to a standard design. It will thus be appreciated that these power plants are completely interchangeable; and it is intended that the entire power plant, complete with engine, shall be removed whenever complete engine overhaul and/or repair become necessary, and to substitute a complete replacement power plant in order to return the aircraft to service within the shortest possible time.

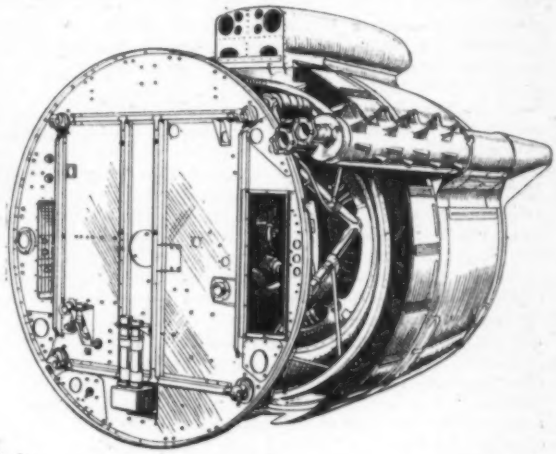
The Engine Cowling

In addition to the basic requirements of the power plant already given, the units are also provided with cowling as far aft as the engine mounting ring, and with the Bristol system of controllable cowling gills, the fairing aft of the gill-ring being an airframe supply, a shoulder cowling is provided for the airframe constructor to attach his fairing panels.

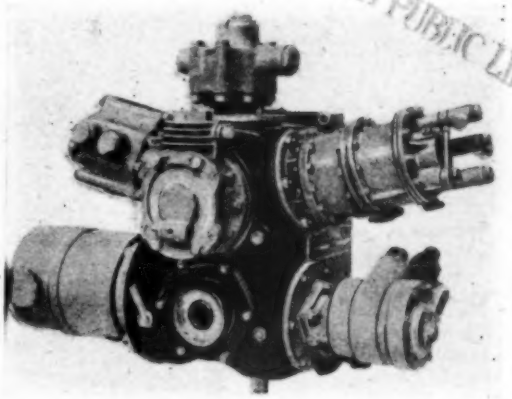
So that the power plant may be adapted to suit any particular airframe, provision is made for the fitting of various additional components, including the Bristol accessory-drive gear box and its accompanying accessories, and one of various types of airscrews. All necessary connections between this equipment and the airframe are made at standardised locations on an "accessories connection panel," which is situated on the power plant bulkhead. The following is a list of standard components which are common to Bristol Hercules basic power plants:

Hercules two-row radial engine.
Air intake.
Exhaust manifold and tail pipe unit.
Engine cowl.
Controllable-gill-ring.
Engine mounting.
Engine controls.
Bulkhead.
Hand-turning gear.
Oil and fuel systems.
Fire-extinguisher equipment.
Gill-operation motor.
Shoulder cowling.

The engine mounting ring consists of two mild-steel pressings which are welded together to form a hollow girder of rectangular section. Seven equally spaced lobes on the inner circumference are bored to take the seven extended crankcase bolts by means of which the engine is secured to the ring. Distance pieces are welded in the interior of the ring at these points to prevent any possibility of crushing, and facing washers are welded at the points of contact to provide a true surface against which the engine can bed. Uniform spacing of the engine from the ring is attained by the use of detachable distance pieces on the crankcase bolts.

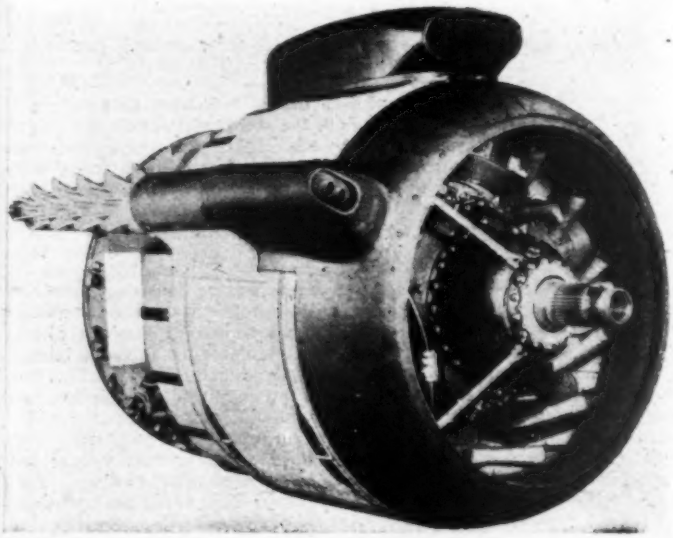


Rear view of power unit, showing bulkhead with its four pick-up points.



The Bristol accessory gear box.

At five points on the after face of the ring are welded support facing pieces, and distance tubes are welded inside the ring. Through these tubes pass the bolts securing the brackets for the engine mounting tube structure. Mounting tube brackets are of two types: the two uppermost and the lowest consist of plates on which lugs are forged for the attachment of the mounting tubes; the remaining two brackets, fitted just above the horizontal centre-line of the ring, have also lugs for lifting purposes. Each bracket is secured to the mounting ring by means of six $\frac{5}{16}$in. stainless-steel bolts and nuts, which are peened over after assembly.



The latest type of Hercules power plant unit.

Triangulation

The mounting tubes are eight in number, and are welded together to form, with the mounting ring to which they are bolted, an approximately triangulated structure. Finger-plates are welded into the forward ends of each of the two uppermost tubes to embrace the lugs on the upper mounting brackets, whilst the lower tubes are welded in pairs to similar finger-plates which pick up the side and lower brackets on the mounting ring. At every joint the welding metal is suitably built up to form

THE HERCULES POWER PLANT

stiffening gussets in the angle of the joint.

Expanding bushes are fitted to avoid the necessity of reaming holes in the mounting brackets and the finger-plates after assembly. Each of these bushes consists of a split sleeve which fits into the holes in the bracket and finger-plate, and has an internal bore in the form of two opposed cones with their wider ends outermost. Cone-ends of similar taper fit into both ends of the sleeve, and the mounting bolt, which passes through the sleeve, draws together the cone ends, thus expanding the sleeve in the bracket and finger-plate bores. Circlips at each end of the sleeve centralise it in the mounting bracket, and the mounting bolts are secured by split-pinned nuts.

Mounting plates are welded in pairs at their after ends to further finger-plates to provide the four lugs by which the power plant assembly is attached to the airframe. Immediately forward of these pick-up points, pressed-steel plates of Y-shape are welded to the mounting tubes for the attachment of the bulkhead, which is secured to each plate by means of sixteen 2 B.A. bolts with plain washers and self-locking nuts. The whole assembly of mounting ring and tubes is painted to protect it from corrosion.

The Bulkhead

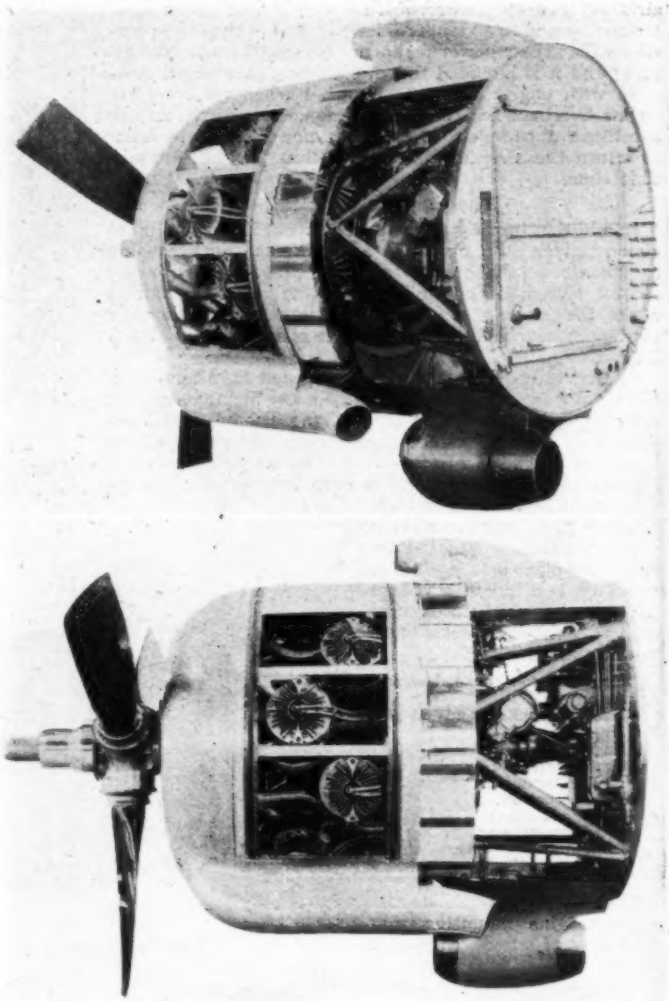
The bulkhead is a single sheet of 20 s.w.g. stainless steel, stiffened by section members on its after face, and an L-section member round the outer circumference, the lip of which extends forward of the bulkhead. These stiffeners are welded or bolted in place, as are the various reinforcing plates which assist local rigidity at those points where the connections for the aircraft services are made.

On the bulkhead are also carried union connections for the various services, such as oil and fuel pipes, the airscrew pitch-control, the fire-extinguisher equipment, and the electrical junction boxes. All these connection points are located in standardised positions, which facilitates interchangeability. Thus when the power plant is installed, the connection points will be correctly situated to register with the pipe-lines, control-tubes, and wiring already fitted in the airframe.

The standard layout of the bulkhead connections includes the following:—

Fuel supply.
Oil supply.
Oil return.
Oil-tank vent.
Primer
Boost gauge.
Fire-extinguisher system.
Cabin heater supply (when fitted).
Cabin heater return (when fitted).
Starter and main electrical junction boxes.
Ignition cut-out.
Pyrometer cable.
Worth oil-dilution system (when fitted).
Thermometer and pressure-gauge capillaries.
Also electrical connection for fuel pressure transmitter.

In order to meet the requirements of the various services and obviate any possibility of incorrect connections, each union of the standard equipment is of a different size or type from the others. The three largest unions are flanged, and each is secured in position by means of six bolts, which pass through a locking plate on the forward face of the bulkhead and the flange of the union body, being secured by plain washers and self-locking nuts. All other unions are secured by locknuts in the usual manner.



An earlier type of "power egg." The oil cooler is mounted below the cowling.

On the starboard side of the bulkhead an aperture is provided to accommodate the accessories connection panel. All pipelines required by the various additional accessories are led to this panel, which, together with its fixing bolts and all connections, is an aircraft supply. Twenty fairing clips are fitted on the circumference of the bulkhead to support the accessory compartment fairing.

Fairing Supports

The supports for the nacelle fairing consist of L-section brackets which extend rearwards and are covered with rubber bonded in place. They combine to form an almost continuous flange round the circumference of the bulkhead. Where the design of the nacelle is such that the fairing cannot be carried directly on the supports, suitable brackets are made up and fitted by the aircraft manufacturer.

Immediately aft of the controllable gill-ring, the power-plant engine mounting is faired off by means of four cowling panels which unite to form the shoulder cowling. They are riveted together in pairs to form two cowl units, one on the port and one on the starboard side. Two locating brackets which fit over the engine mounting ring are provided on each cowl unit; and each has a rubber block

THE HERCULES POWER PLANT

cemented in place to prevent metal-to-metal contact with the ring.

A pressed-steel bracket supports the electric motor which operates the controllable gills, and an aperture is formed in the starboard cowl unit to give the requisite clearance for the drive to the gill unit. Further apertures are provided in the cowling units to accommodate the engine oil pipes, air-intake control rod, the hydromatic airscrew feathering pipe, and, where fitted, the return pipe for the cabin-heating system.

Mounted on the port side of the bulkhead is the engine control box, and the control rods from the cockpit are connected to it; they convey the necessary movement to the carburettor, air intake, two-speed blower and constant-speed airscrew control, through a series of levers and control tubes.

The Fuel Union

The fuel supply from the tanks in the aircraft is led to a union on the power plant bulkhead which communicates directly with a fuel filter mounted on the forward face of the bulkhead; and thence by a length of flexible hose pipe to the fuel pump on the rear cover of the engine. The main oil feed from the oil tanks in the airframe is also brought to a union on the bulkhead, and from there by a flexible hose pipe to the oil pump on the rear cover of the engine. In certain installations an oil cooler is incorporated in the aircraft and is connected through the bulkhead to the carburettor oil jacket. When the oil cooler is incorporated in the power plant, it is slung below the bottom fairing panel and cowled-in to reduce air drag and promote the necessary airflow.

Provision is also made on the bulkhead for fire-extinguisher pipe lines and hydraulic control connections. Thermometer and pressure gauge connections are made on the bulkhead, with provision for the necessary pipes for a cabin-heating system, either by hot air or by a hot-water system employing a boiler on the exhaust pipe.

In order to identify the internal pipe lines of the power plant, each pipe carries one or more coloured bands near each end, indicating the system of which it forms part. The width of the band varies according to the outside diameter of the pipes concerned, and all the pipe lines in the standard power plant are of different sizes as a further aid to identification.

For the electrical equipment four junction boxes or connection plugs are mounted on the bulkhead, designed to pre-determined standards of interchangeability. The main junction box provides connecting points for the adjustable cowling-gill motor, the fire-extinguisher switches, the engine-speed indicator, motor starter, and such variable items of equipment as airscrew, gill-position indicator, booster coil, etc. Where any items of variable equipment are not fitted, the connections are suitably blanked off by means of caps, which screw on to the flanges on the box. The electric cables are carried in flexible conduits with terminal blocks in which the contact sockets are embedded. Electric and hand-turning gear is fitted to the power plant for starting the engine, the starter motor being attached to the rear cover of the engine.

The power-plant controls on the standardised Bristol Hercules power unit are completely adjusted by the manufacturers, so that little or no work is required forward of the bulkhead when the unit is changed or installed in an aircraft. The unit may be installed or removed from the airframe either with or without the airscrew, and with the tail of the aircraft either up or down. The power plant is lifted by a suitable slinging gear which is included in the flight tool kit. It is hoisted into position by a derrick or mobile crane, and attached to the airframe by the four mounting bolts. When all connections have been made and the engine controls checked, the fuel system is also checked and the work of installation is practically complete. There remains only the replacement of the fairings on the nacelle and on the power plant, and the reassembling of the cowling is then completed.

AIR MINISTRY PUBLIC LIBRARY

NORTH AFRICAN RESCUE

'UNITS of the Royal Air Force, the Army and the Royal Navy have combined in the rescue of survivors of a crashed aircraft and saved a man's life under remarkable circumstances. The aircraft force-landed on a desolate patch of salt marshes on the North African coast. One member of the crew was killed, and the aircraft and supplies were burnt out. Of the three survivors, an Australian, a South African and a New Zealander, the last-named was very badly injured.

An aircraft of the R.A.F. Sea Rescue Service located the crash very quickly and dropped water and medical supplies by parachute. An army unit in the area was contacted, and a party set off in a "jeep" to attempt a rescue. The going was almost impossible. The car broke down completely half a mile from the wrecked aircraft and the party struggled forward on foot. Meanwhile, a two-seater aircraft had landed a medical officer beside the wreck. He found that the injured man required an immediate operation and must be kept in a horizontal position. Later another aircraft put down, but while this was suitable for conveying the injured man, the machine could not take off on account of the treacherous surface.

During this time a sea-rescue aircraft was constantly at work ferrying supplies and dropping dozens of rolls of matting. With this aid, the two-seater finally took off in darkness, with the headlights of the distant stranded jeep for a guide.

At dawn next day a naval high-speed launch came round the coast about two hundred yards away. With the aid of rubber and wooden dinghies the injured New Zealander and his two companions were conveyed out to the launch.

The injured airman was rushed to hospital at the nearest port and an immediate operation performed. The many members of the three Services who co-operated in the rescue were rewarded by the news that the New Zealander is almost certain to recover.

Paper Economy Committee

THE Minister of Production has appointed a "Paper Economy Committee" to assist him in obtaining a much needed reduction in the consumption of paper. The Committee will examine all cases of excessive use of paper and take the necessary steps to effect economy. It is not concerned with the collection of waste paper.

Communications to the Committee at 3, Central Buildings, Westminster, S.W.1, will be welcomed, but in the interests of economy will not be acknowledged unless further information is required.

Annual Extra Issue of "The Automobile Engineer"

THIS year the subject of producer gas is a matter of some interest and importance as constituting the most practical alternative fuel in the present circumstances. For this reason the annual extra issue of *The Automobile Engineer*, published on November 5th, is devoted in the main to the various designs available. A brief summary of certain other alternative methods of propulsion is included, with some reference to gas, steam and electricity.

The Automobile Engineer is published each month by Iliffe & Sons Ltd., price 2s. 6d.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

TEST PILOTS

Hard to Improve on Present System

WHAT is all this pother about test flying?

Are there really some manufacturers who insist that their pilots pass unairworthy production aircraft? Are there test pilots who are unable to tell when an aircraft is out of trim, or has controls and stability that differ from the standard machine? If so, the R.A.F. should demand that M.A.P. add quality (where it is deficient) to quantity, and insist on adequate aeronautical education not only for the test pilot but for the manufacturer.

When it comes to the development of prototypes I doubt if the present system could be improved.

In the first place, the aircraft is no more than the designer's interpretation of what the specification makes it. In the second, it is developed from that point by an aerodynamic staff and a specially trained pilot, who have had years of practice in the tricky science of making bad controls usable, dangerous instabilities reasonable, and faulty installations safe.

The flying and operational qualities usually are improved out of all recognition subsequent to the first flight, but there comes a time when experimental work must end if there is to be production before the aircraft is outmoded. The firm's test pilot must be able to co-ordinate the aerodynamic with the "economic and politico-domestic" influences, and recognise the earliest moment to call a stop to development.

The third step is in the nature of a safeguard—when experienced R.A.F. pilots of the A. and A.E.E. check the operational qualities and the performance. Their job is not to make the machine safe or nice to fly, but to compare its characteristics with that of other contemporary aircraft in order to endorse the opinion of the manufacturer's test pilot that the aircraft has been developed to a suitable stag to warrant its value as a fighting weapon.

After this there is a fourth stage, when the aircraft is flown by a non-technical squadron, representative of the pilots who will use the class operationally. During the intensive flying a host of minor faults may come to light which would otherwise only be discovered when the type was well advanced in production.

The development has thus gone through a logical sequence of fault elimination—from making the aircraft fly to making it last—during which time twenty pilots or more will have flown it. Any faults that remain by that time will have been long recognised, but are there because they cannot *reasonably* be eradicated, or because their elimination gives rise to other faults which are even more detrimental "PASSER-OFF."

INTERCHANGEABLE POWER PLANTS

Abuse of Large Detachable Panels

MR. JOHN F. FLUDE'S letter (*Flight*, October 8th) raises a number of interesting observations with regard to the latitude required in cowling fasteners.

Owing to the necessity for reducing weight to a minimum the structure for the attachment of cowling fasteners is usually somewhat flexible and liable to distortion. Combined with this there is a tendency to make the panels large and unwieldly. In some instances it takes three or four mechanics to remove and replace a single panel.

The effect of unduly large panels of fantastic shapes is that the distortion due to the unwarranted severe mishandling in service, combined with a certain amount of stretching, causes misalignment between the holes in the panels and those in the structure to the extent of as much as ¾in.

It would appear that the tendency is to blame cowling fasteners generally, rather than seek the root of the trouble, a lot of which could be obviated by reducing the size of the panels so that they could be handled by one man.

Enough detailed attention is not generally paid to the instructions issued by cowling fastener manufacturers. Cowlings and cowling fasteners seem still to be regarded with much less attention than is paid to removable panels secured by bolts.

One does not expect bolts which secure, for example, a wing panel to have a tolerance of plus or minus, say, ¼in. Why therefore should cowling fasteners, which in effect are only quickly detachable bolts, be expected to cater for gross negligence and careless attention to design details?

A number of the well-known fasteners at present in use provide ample tolerance for interchangeability, and it has been found that the more tolerance that is provided, the greater is the abuse of the fastener.

The problem of providing a fastener with exceptional tolerance, lightness, compactness, low cost, minimum number of parts, positive locking, simple and quick in operation and ability to withstand rough usage has been the aim of every cowling fastener manufacturer, and a few have succeeded in attaining these ideals within limits. It would appear, therefore, that more attention to the design of smaller and more easily removable panels, and fair treatment of cowling fasteners and panels in service, would go a long way to provide interchangeability and eliminate the unwarranted adverse criticisms which are generally hurled upon cowling fasteners by persons who are either unqualified or unwilling to seek the basic causes of the trouble. "SERVICE ENGINEER."

VALUE OF BOMBING

Air Force the Most Versatile Service

THERE has lately been much talk of whether or not bombing alone can bring about the defeat of Germany.

Some of us maintain that this can only be effected by opening a Second Front while others believe that if we can keep up very heavy bombing both day and night either German morale will collapse or the industrial output of the country will be so smashed that its capacity for war would be negligible.

With the arrival of large American forces in Britain it seems more reasonable to suppose that bombing, or rather aviation in general, can play a decisive part in winning the war. The Air Force is certainly the most versatile of the three Services, since it can function as an independent force and also give invaluable help to the Army and Navy.

What, then, is more natural than that it should take the most prominent position in the war? The Navy must keep the seas open, but the Army might, with advantage, be reduced to a hard core of highly trained fighting men, mainly air-borne, to be used to consolidate positions after the aircraft have gone before and done their work, be it bombing, fighting, reconnaissance or straffing. "QUEEN BEE."

CONSERVATION OF FUEL

Pump Water During Test Running

I HAVE been interested in the various letters concerning suggestions for converting to useful work the enormous quantity of power which is at present thrown away whilst testing aircraft engines.

The obvious answer to this problem is, as has already been discussed, namely, connecting these power units to generators for electric supply, but unfortunately things are not quite so easy as at first seems owing to the fluctuating power and speed during test, particularly with acceleration bursts.

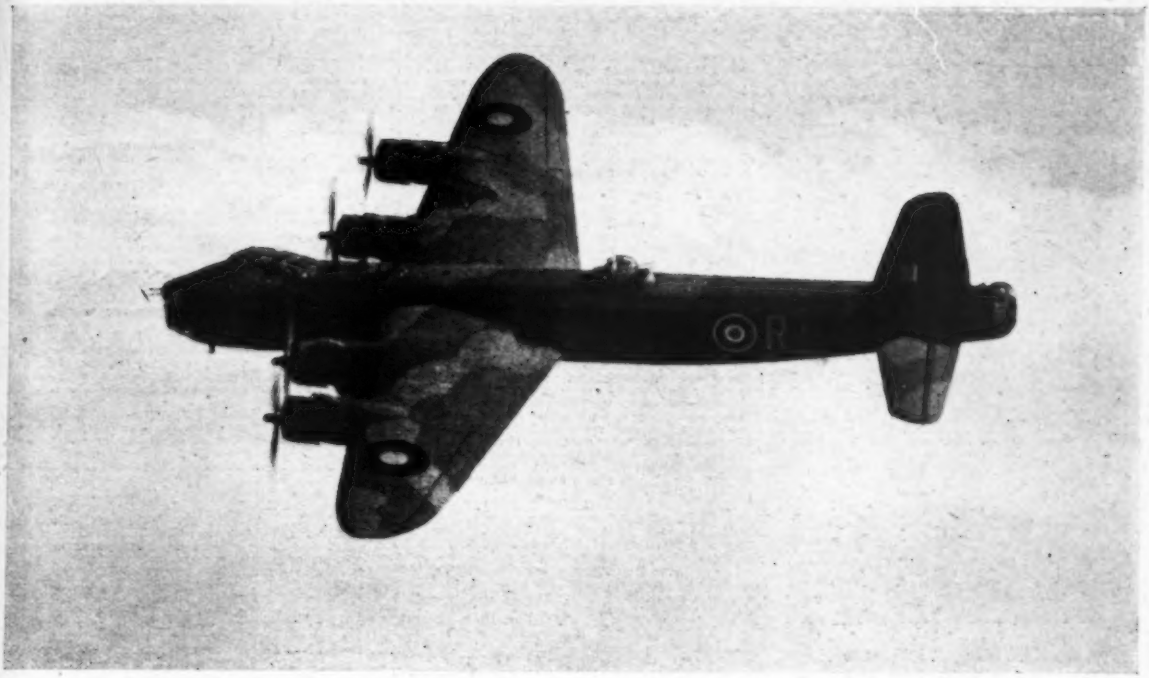
There is, however, one way which has occurred to me which would surmount this difficulty; a sketchy outline of this scheme is to employ these engines in pumping water to a higher level. The site for the testing beds would need to be specially chosen—for example, the Lake District. The engines could then be put to work shifting, say, Lake Windermere to the summit of one of the nearby hills in a suitable reservoir. This potential energy could then be used to turn generators.

The great advantage of this arrangement is that the generators could be run when required and at any desired load.

"DERBY."

Key to Composite Non-such No. 2 on page 499

(1) Port wing, *Hudson;* (2) port engine, *Do 217E;* (3) port undercarriage, *Anson;* (4) starboard wing, *Beaufort;* (5) starboard engine, *Ju 88;* (6) starboard undercarriage, *Bothu;* (7) nose, *Wellington II;* (8) under turret, *He 111 HaE;* (9) rear fuselage, *Beaufighter;* (10) port tail assembly, *Hampden;* (11) starboard tail assembly, *Me 110.*



A new photograph of the Short Stirling which shows its efficient lines to their best advantage.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Indian Air Command

AIR MARSHAL J. E. A. BALDWIN has arrived in India to take up the post of Deputy Air Officer Commanding-in-Chief. This new post has been created because of the expansion of the air forces in India.

Promotions

The London Gazette, October 20th, 1942.

TECHNICAL BRANCH.

Air Comdre. K. M. St. C. G. LEASK, M.C., to be Act. Air Vice-Marshal. August 21st, 1942.

Awards

THE KING has been graciously pleased to give orders for the undermentioned appointments to the Most Excellent Order of the British Empire and the following award of the British Empire Medal:—

M.B.E. (MIL.)

Flt. Lt. B. ROFE, R.A.A.F.
Flt. Lt. A. F. COLE, R.A.A.F.

Flt. Lt. Rofe was left at Timor as senior officer in command of a small party of officers and men after the evacuation from Koepang. He organised the destruction of all wireless equipment, bombs and stores before taking to the hills to avoid capture and for two months he kept the party together under great hardship. By means of a portable wireless set Flt. Lt. Rofe kept Darwin supplied with important information. Although called upon to surrender, and living under appalling conditions, he continued to resist until rescued two months later. Flt. Lt. Cole, who was second in command to Flt. Lt. Rofe, rendered faithful and valuable assistance. His courage in assisting the weaker members of the party to fight against fever was of inestimable value. When the party was seriously attacked by fever in the jungle and there were no medical supplies, Cpl. Borgelt proved himself invaluable in sustaining the morale and spirits of the party. He displayed great strength of character, tenacity and courage.

B.E.M. (MIL.)

Cpl. L. R. BORGELT, R.A.A.F.—For citation see Flt. Lts. Rofe and Cole.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

DISTINGUISHED SERVICE ORDER

Sqn. Ldr. B. PADDON, No. 40 Sqn.

Wing Cdr. W. A. J. SATCHELL, R.A.F.O.—In the Battle of Britain this officer destroyed at least two enemy aircraft. At Malta he has participated in both day and night sorties, invariably against great odds. He has always displayed great keenness to engage the enemy, and, in combat at Malta, he has destroyed two Me.109s and a Ju.88. On one occasion he led a formation of four Hurricanes and three Spitfires against a force of over 100 hostile fighters which were attacking the island. During the engagement fourteen enemy aircraft were destroyed without loss to our formation. In intruder raids he has destroyed enemy vehicles and damaged trains. Whilst in command of a R.A.F. station, during the heaviest German air attacks, Wing Cdr. Satchell set a superlative example. Manning his own machine-gun post, he destroyed at least one, and damaged many more enemy aircraft. In this difficult period his leadership, courage and fine fighting qualities were worthy of the highest praise.

Act. Wing Cdr. B. R. O. HOARE, D.F.C., R.A.F.O., No. 23 Sqn.—This officer has completed numerous operational sorties over enemy occupied territory, during which he has destroyed six enemy aircraft. Since Wing Cdr. Hoare assumed command of his squadron the squadron has destroyed at least seven enemy aircraft, and damaged others.

Act. Sqn. Ldr. J. R. D. BRAHAM, D.F.C., No. 29 Sqn.—Since being awarded a bar to the D.F.C., Sqn. Ldr. Braham has destroyed a further four enemy aircraft, bringing his total victories to ten. On one occasion his aircraft sustained much damage and one engine was put out of action when at an altitude of only 150 feet. Nevertheless, displaying great courage and determination, he completed the return journey and made a safe landing on a small emergency landing ground.

Act. Sqn. Ldr. W. G. LOCKHART, D.F.C., R.A.F.V.R., No. 161 Sqn.—Sqn. Ldr. Lockhart has participated in many operational sorties, and the successes gained can be attributed largely to his careful organisation and planning.

Act. Sqn. Ldr. D. A. G. PARRY, D.F.C., R.A.F.V.R., No. 105 Sqn.—On September 25th, 1942, this officer led a formation of bombers de-

A portrait of Group Capt. A. S. W. Dore, D.S.O., T.D., D.L., by Frank E. Beresford. Group Capt. Dore is Deputy Director of Allied Air Co-operation and Foreign Liaison.

SERVICE AVIATION

Sqn. Ldr. H. Young, at present serving in the Middle East, who has been awarded a Bar to his D.F.C.

tailed to attack the Gestapo Headquarters on the occasion of the Quisling Rally at Oslo. On reaching the city, Sqn. Ldr. Parry vigorously attacked his objective from roof-top height and obtained hits on the centre of the buildings, despite interference by enemy fighters.

Act. Flt. Lt. J. R. G. RALSTON, D.F.M., No. 105 Sqn.—In September, 1942, Flt. Lt. Ralston and W/O. Armitage were pilot and observer respectively of one of a formation of bomber aircraft detailed to attack a factory at Wiesbaden. The sortie involved a flight deep into German territory in daylight. Nevertheless, the objective was reached exactly as planned and subjected to vigorous bombing, hits being obtained.

F/O. J. P. TRENCH, R.A.F.V.R., No. 7 Sqn.—One night in September, 1942, F/O. Trench, P/O. Selman and Sgt. Edwards were captain, navigator and wireless operator respectively of an aircraft of a bomber force which attacked Dusseldorf. Whilst over the target area the aircraft was repeatedly hit by anti-aircraft fire. The petrol tanks were pierced, while some oil pipe lines were severed. In spite of this, F/O. Trench persisted in his mission, and the target was bombed successfully. On the return journey the aircraft lost height. All movable equipment, even parachutes, were jettisoned in an effort to maintain height, and the North Sea was eventually crossed at between 100 and 200 feet. After crossing the English coast the aircraft was force-landed and, on impact with the ground, burst into flames. F/O Trench and Sgt. Edwards were rendered unconscious, but P/O. Selman, with complete disregard of danger extricated his comrades and pulled them clear of the burning aircraft.

BAR TO THE DISTINGUISHED FLYING CROSS

Act. Flt. Lt. WADE, D.F.C., R.A.F.V.R., No. 33 Sqn.—Since being awarded the D.F.C. this officer has destroyed seven enemy aircraft, thus bringing his total victories to fifteen. In September, 1942, during a reconnaissance patrol his aircraft was attacked by some eight Italian fighters. Flt. Lt. Wade, however, fought them off. By his skill and determination he contributed materially to the success of the reconnaissance and much valuable information was obtained.

Act. Sqn. Ldr. R. C. BISSET, D.F.C., R.A.F.O. (deceased), No. 405 (R.C.A.F.) Sqn. Awarded with effect from November 23rd, 1941.—This officer has led his flight in an exemplary manner, participating in most difficult and lengthy sorties. He has outstanding qualities of leadership, and has set a fine example by his skill and courage. He has participated in many raids on German industrial targets and in two raids on Turin.

GRP. CAPT. H. BROADHURST, D.S.O., D.F.C., A.F.C.—In the combined operations against Dieppe on August 19th, 1942, this officer flew with great distinction. He completed several sorties during which he constantly flew amongst enemy bomber and fighter patrols. Although he was several times engaged by hostile aircraft, one of which he destroyed, Grp. Capt. Broadhurst displayed great skill and furnished much valuable information regarding the trend of the air operations. In the course of his duties he flew alone for some eight hours in an area where hostile patrols were operating in great strength.

Act. Sqn. Ldr. L. S. FORD, D.F.C., R.C.A.F., No. 403 (R.C.A.F.) Sqn.—On August 19th, 1942, this officer led his squadron in support of the combined operations against Dieppe with great skill. Several enemy aircraft were destroyed, two of which were shot down by Sqn. Ldr. Ford.

Sqn. Ldr. D. PARKER, D.F.C., R.A.F.O., No. 29 Sqn.—As pilot and observer respectively, Sqn. Ldr. Parker and Flt. Sgt. Croysdill have flown together on numerous sorties, and both have displayed a high standard of skill, determination and fortitude. Their excellent co-operation has led to the destruction of at least two enemy aircraft at night.

Flt. Lt. D. CROWLEY-MILLING, D.F.C., R.A.F.V.R., No. 610 Sqn.—Since being awarded the D.F.C. in March, 1941, this officer has completed 56 sorties over enemy occupied territory and has destroyed at least one hostile aircraft.

Flt. Lt. D. J. SCOTT, D.F.C., (R.N.Z.A.F.), No. 3 Sqn.—Since being awarded the D.F.C. this officer has completed numerous intruder sorties and has destroyed two and damaged several more enemy aircraft. In other sorties he has attacked enemy shipping. Ft. Lt. Scott is an outstandingly successful flight commander.

Act. Flt. Lt. M. FOULIS, D.F.C., R.A.F.V.R., No. 38 Sqn.—One night in August, 1942, this officer was the captain of an aircraft detailed to attack enemy shipping. A merchant vessel was located and, although it was escorted by three destroyers which put up a fierce barrage, Flt. Lt. Foulis attacked the vessel with the utmost determination. Hits were obtained, causing a violent explosion and columns of water were thrown up 150 feet in height. The ship became enveloped in smoke and, when this cleared, only a patch of oil could be seen.

Act. Sqn Ldr. G. H. EVERITT, D.F.C., R.A.F.V.R., No. 50 Sqn.—One night in August, 1942, Sqn. Ldr. Everitt and F/O. Hay, as captain and navigator of aircraft respectively, were detailed to execute a special bombing sortie. In spite of difficulties they accomplished their task successfully and brought back excellent photographs. Sqn. Ldr. Everitt and F/O. Hay have completed many sorties.

Act. F/O. H. W. W. BERRIDGE, D.F.C., R.A.F.V.R., No 219 Sqn.—F/O. Berridge is a highly efficient observer. He has at all times displayed great devotion to duty and set an example worthy of attainment. Since being awarded the D.F.C. he has achieved much success.

DISTINGUISHED FLYING CROSS.

P/O. C. L. SELMAN, R.A.F.V.R., No. 7 Sqn.—For citation see F/O Trench.

W/O. J. L. ARMITAGE, No. 139 Sqn.—For citation see Flt. Lt. Ralston, D.F.M.

F/O. R. C. HAY, R.A.A.F., No. 50 Sqn.—For citation see Sqn. Ldr. Everitt, D.F.C.

Sqn. Ldr. G. HOWDEN, R.A.F.O., No. 68 Sqn.—This officer has been engaged on operational flying since the war began. He has completed numerous sorties and had destroyed at least two enemy aircraft and damaged several others.

Act. Flt. Lt. G. A. WILKINS, No. 50 Sqn.—This officer has completed numerous sorties in heavy bombers. On two nights in August, 1942, he captained an aircraft detailed for mine-laying operations of great importance. In spite of adverse weather, Flt. Lt. Wilkins completed his task successfully. He has also participated in attacks on many highly defended targets and has invariably pressed home his attacks in a very determined manner.

F/O. A. N. BRISTOW, R.A.F.V.R., No. 105 Sqn.
P/O. B. W. MARSHALL, R.A.F.V.R., No.105 Sqn.

On September 25th, 1942, F/O. Bristow and P/O. Marshall were pilot and observer respectively of one of a formation of aircraft detailed to attack the Gestapo Headquarters during the Quisling Rally at Oslo. Whilst over the target area the formation was intercepted by enemy fighters, but, evading them, F/O. Bristow pressed home his attack and bombed the objective.

F/O. R. O. CALVERT, R.N.Z.A.F., No. 50 Sqn.
P/O. J. A. SEARS, R.A.A.F., No. 50 Sqn.

F/O. Calvert and P/O. Sears, as pilot and navigator of aircraft respectively, have flown together on many sorties. Whatever the weather or the opposition they have always endeavoured to press home their attacks, and, on numerous occasions, have obtained excellent photographs.

Through Flames

F/O. C. K. SILCOCK, R.N.Z.A.F., No. 44 (Rhodesia) Sqn.—One night in September, 1942, this officer captained an aircraft detailed to attack an objective in Northern Germany. On arrival at the target area, F/O. Silcock descended to only 60 feet and, despite barrage balloons and anti-aircraft fire at point-blank range, he released his incendiary bombs over the objective. F/O. Silcock piloted his aircraft through the tops of the flames which rose from burning buildings. The whole fuselage was filled with smoke and pieces of burnt ash.

Wing Cdr. G. F. W. HEYCOCK, No. 141 Sqn.—By his thorough knowledge, skill and untiring efforts, this officer has built up the squadron he commands into a most efficient unit, thereby contributing materially to the successes obtained. In August, 1942, his squadron shot down at least four enemy aircraft at night.

Wing Cdr. D. R. SHORE, A.F.C., No. 227 Sqn.—This officer has led his squadron on a number of successful attacks against enemy shipping in the Mediterranean. His squadron has also shot down numerous enemy aircraft, one of which Wing Cdr. Shore destroyed.

Act. Sqn. Ldr. R. J. C. GRANT, D.F.M., R.N.Z.A.F., No. 485 (N.Z.) Sqn.—Since being awarded the D.F.M., Sqn. Ldr. Grant has completed numerous sorties and has destroyed three enemy aircraft.

Act. Sqn. Ldr. R. B. NEWTON, R.A.F.V.R., No. 411 Sqn.—This officer has completed some 60 sorties over enemy territory. During the combined operations at Dieppe his fine qualities were well to the fore.

Act. Sqn. Ldr. C. V. WINN.—This officer has displayed great keenness to engage the enemy. One night in April, 1942, Sqn. Ldr. Winn assisted in the destruction of a He. 111.

Act. Sqn. Ldr. D. S. YAPP, No. 253 Sqn.—During the recent combined operations against Dieppe on August 19th, 1942, this officer led his squadron in low-level attacks on gun positions and strong points. His skill and determination contributed materially to the success attained.

Flt. Lt. M. M. SHAND, R.N.Z.A.F., No. 485 (N.Z.) Sqn.—A skilful pilot and a fearless leader, this officer has completed 60 sorties over Northern France. In low-level attacks against the enemy's transport he has achieved much success.

Act. Flt. Lt. R. W. BAKER, R.N.Z.A.F., No. 485 (N.Z.) Sqn.—This officer is an excellent flight commander whose fine fighting qualities have fostered a high standard of morale amongst his fellow pilots. He has completed numerous sorties over enemy occupied territory.

Act. Flt. Lt. E. G. BRETTELL, R.A.F.V.R., No. 133 (Eagle) Sqn.—This officer has participated in 111 sorties over enemy occupied territory. On one occasion he was wounded in combat and, on recovery, he resumed operational flying with renewed zest.

Act. Flt. Lt. D. H. H. GATHERCOLE, R.A.F.V.R., No. 245 Sqn.—This officer has completed numerous sorties against the enemy both by day and at night. During the recent combined operations he led his flight in attacks on the beaches at Dieppe.

Kassel Attack

Act. Flt. Lt. D. J. WILLIAMS, No. 408 (R.C.A.F.), Sqn.—This officer has participated in bombing attacks against many of the enemy's important and heavily defended targets. One night in August, 1942, he was the captain of an aircraft detailed to attack Kassel. On the outward flight his aircraft was intercepted by a Ju. 88. By skilful tactics, Flt. Lt. Williams enabled his gunners to deliver effective bursts at the attacking aircraft, setting one of its engines on fire. It then dived steeply towards the ground where, on impact, it exploded. Although his own aircraft had sustained damage, Flt. Lt. Williams pressed on to his target and bombed it. On the return journey a Me. 109 was encountered and driven off by a well-directed burst of fire. Throughout this officer displayed great determination to complete his allotted task.

F/O. S. A. MAURIELLO, R.A.F.V.R., No. 71 (Eagle) Sqn.—This officer has completed numerous sorties over enemy occupied territory. He has destroyed two enemy aircraft.

P/O. H. DAVIES, R.A.F.V.R., No. 174 Sqn.—This officer has completed numerous sorties during which the enemy's airfields, industrial plants, docks, and other targets have been attacked. He flew with distinction in the recent combined operations at Dieppe.

P/O. G. B. MURRAY, R.C.A.F., No. 401 (R.C.A.F.) Sqn.—P/O. Murray has carried out 61 sorties. He is an excellent leader, whose resource and skill in action have proved inspiring.

P/O. J. W. REYNOLDS, R.C.A.F., No. 174 Sqn.—This officer has completed numerous sorties, involving low flying attacks on important enemy industrial targets and airfields in Northern France. In the recent combined operations at Dieppe, P/O. Reynolds participated in attacks on the enemy's gun positions.

F/O. D. D. BONNETT, No. 49 Sqn.—F/O. Bonnett and Sgts. Dangerfield and Myers as captain, navigator and wireless operator respectively have flown together on many sorties. Each, in his particular role, has displayed exceptional ability. F/O. Bonnett, who has spared no efforts in training his crew to the highest standard of efficiency, has always displayed the greatest determination to make every sortie a success and, resolutely and ably supported by Sgts. Dangerfield and Myers, has invariably succeeded in so doing.

Act. W/O. L. A. JOHNSON, R.C.A.F., No. 214 Sqn.—One night in July, 1942, W/O. Johnson and Sgts. Agg and McGown were captain and air gunners respectively of an aircraft detailed to attack Saarbrucken. Before the target was reached the aircraft was engaged by a Me. 110. Sgts. Agg and McGown met several attacks with resolute fire and succeeded in destroying the attacker. The skilful airmanship of W/O. Johnson contributed materially to this success.

On another occasion in August, 1942, this air crew were detailed to attack Nuremburg. On the outward flight, whilst still a considerable distance from the target, their aircraft was intercepted by an enemy fighter. Skilful manœuvring by W/O. Johnson enabled his gunners to deliver their fire from a favourable position and destroy the attacker. Despite damage sustained to his aircraft, W/O. Johnson continued his mission, located his target, and bombed it.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. W. R. CROYSDILL, No. 29 Sqn.
For citation see Sqn. Ldr. PARKER, D.F.C
Sgt. R. W. AGG, No. 214 Sqn.
Sgt. J. MCGOWN, No. 214 Sqn.
For citations see Act. W/O. JOHNSON.
Sgt. I. J. EDWARDS, No 7 Sqn.—For citation see F/O. Trench.
Sgt. R. D. DANGERFIELD, R.A.A.F., No. 49 Sqn., and Sgt. W. H. L. MYERS, R.A.A.F., No. 49 Sqn.
For citation see F/O. Bonnett.
Flt. Sgt. C. P. KING, No. 263 Sqn.—In the course of many sorties Flt. Sgt. King has inflicted much damage on enemy targets. He is a skilful and determined pilot, whose example has been most praiseworthy. He has destroyed one enemy aircraft.

Sgt. C. CHAPMAN, R.A.A.F., No. 150 Sqn.—One night in August, 1942, this airman was the front gunner of an aircraft detailed to attack Mainz. On the outward flight the aircraft was hit and damaged by anti-aircraft fire but the pilot pressed on and bombed the objective. On the return journey the aircraft was attacked by an enemy machine and sustained further damage. The rear gunner was killed and the wireless operator seriously wounded. Displaying great coolness, Sgt. Chapman left his turret and assumed the wounded operator's duties. His subsequent efforts proved of the greatest assistance to his pilot and contributed materially to the safe return of the aircraft to its base.

On another occasion, when his aircraft was intercepted by a Ju. 88, Sgt. Chapman's well-directed fire caused the attacker to explode in the air. A few seconds later, another Ju. 88 attacked, but, after Sgt. Chapman and the rear gunner had fired several bursts, the enemy aircraft caught fire and disappeared.

Sgt. W. S. G. BELTON, No. 156 Sqn.—One night in September, 1942, this airman was the rear gunner of an aircraft which formed part of a force operating against a target in the Ruhr. During the bombing run, his aircraft was attacked by a hostile aircraft; but, following an accurate burst from Sgt. Belton's guns, the attacking aircraft burst into flames and afterwards crashed on the ground. On a previous occasion, when his aircraft was attacked by an enemy fighter, Sgt. Belton skilfully fought it off.

Flt. Sgt. J. D. C. CUMMING, R.N.Z.A.F., No. 38 Sqn.—As wireless operator, this airman has taken part in numerous sorties. One night in September, 1942, he was a member of the crew of an aircraft which made a successful attack on an enemy ship. The aircraft was damaged by anti-aircraft fire which rendered the wireless equipment unserviceable. Although wounded in both arms and in the thigh Flt. Sgt. Cumming, after receiving first aid but still being in much pain, effected temporary repairs to the wireless set and was able to send messages indicating the position of the damaged aircraft. Throughout the homeward flight, his courage and fortitude inspired his comrades.

Sgt. G. A. NEILL, R.A.A.F., No. 3 (R.A.A.F.) Sqn.—In September, 1942, this airman participated in an engagement against a large formation of enemy fighters escorting dive bombers. Diving through the fighters, Sgt. Neill made a head-on attack on a Stuka, destroying it. On regaining height again through heavy anti-aircraft fire, he attacked a Me 109. Following it down to about 20 feet he delivered a few bursts and the enemy aircraft crashed to the ground. In two previous sorties Sgt. Neill destroyed an enemy aircraft on each occasion.

Flt. Sgt. P. CAMPBELL, No. 61 Sqn.
Sgt. S. D. GUNNELL, No. 61 Sqn.
Sgt. E. H. CORBETT, No. 61 Sqn.
Sgt. F. C. BUNCLARK, No. 61 Sqn.
Sgt. C. H. COAKLEY, No. 61 Sqn.
Sgt. S. SMITH, No. 61 Sqn.
Sgt. S. J. THOMPSON, No. 61 Sqn.

These airmen were members of the crew of a heavy bomber detailed for an operational mission one night in September, 1942. Flt. Sgt. Campbell was captain and first pilot. The allotted task was completed successfully, but, whilst on the return flight, the aircraft was hit by anti-aircraft fire. A shell exploded in the bomb compartment, starting a large fire and setting some flares and distress signals alight. Simultaneously, another shell burst in the nose of the aircraft, shattering the perspex as well as the major portion of the perspex of the pilot's cupola. The resultant rush of air through the aperture swept away all the navigational charts and maps and flung Sgts. Gunnell and Bunclark backwards on to the floor of the aircraft. Both suffered facial burns, as did the pilot, the navigator, the wireless operator and the mid-upper gunner. The aircraft became full of smoke, and it was attacked by two enemy fighters. The pilot could not see his instruments, and the aircraft went out of control and fell 2,000 feet before Flt. Sgt. Campbell regained control and evaded further attacks by diving and reaching cloud cover.

Meanwhile the flames in the fuselage had extended, causing ammunition to explode in all directions. Despite this, Sgts. Corbett, Bunclark and Smith fought their way through the flames to the rear turret to extricate Sgt. Thompson who, despite suffering from a broken leg and being unable to operate his guns, had greatly assisted his captain by reporting the position of the attacking aircraft. Sgt. Coakley, in spite of his injuries, and with amazing skill in the circumstances, established wireless contact with base and continued to obtain bearings throughout the homeward flight. When this country was reached, Flt. Sgt. Campbell, who had displayed fine captaincy, resumed the controls and landed the damaged aircraft safely with the undercarriage retracted and without the aid of flaps.

Roll of Honour

Casualty Communiqué No. 170.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. B. A. Basevi; Sgt. R. Ellis; Sgt. E. Hampson; Sgt. H. Hannah; Sgt. O. A. Jones; Sgt. R. R. McCormack; Sgt. Y. J. Markham; Sgt. J. E. Veal.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. P. R. S. Brooke; Sgt. D. A. Brunton; Sgt. T. R. Buckley; Sgt. P. J. Coleman; Sgt. E. F. Collins; Sgt. V. A. L. Ellis; Sgt. J. Evans; Flt. Lt. E. Fox; Sgt. D. I. Groves; P/O. D. R. Hart; P/O. J. A. Hilton; P/O. R. Huggins; Sgt. R. Jacques; Sgt. J. F. Lait; Sgt. D. G. McLaren; Sgt. C. V. Maddock; Sgt. H. Morey; Sgt. C. F. Myhill; Sgt. A. Naylor; Sgt. T. N. Pugh; P/O. R. E. Taylor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—A/C.1 A. H. Agus; Sgt. I. Allan; Sgt. J. D. Ashcroft; A/C.1 T. H. Atkin; A/C.2 W. Benson; Sgt. J. F. Billett; Flt. Lt. J. W. Blennerhassett; Sgt. R. Brown; Sgt. M. Bryan; Sgt. W. Chalmers; Sgt. A. S. Chantrell; Sgt. P. B. Chapple; Sgt. H. S. E. Ellis; Sgt. R. G. Eves; F/O. S. G. H. Fawkes; Sgt. L. J. Harris; Flt. Sgt. B. Hayes; Sgt. W. Holland; Sgt. G. H. Hunt; Sgt. R. J. Kennedy; Sgt. D. M. Kingston; Sgt. K. C. Lawry; Sgt. P. F. Lill; Sgt. W. C. Marshall; Flt. Sgt. W. H. Martin; P/O. A. G. Pickett; Sgt. W. D. Reason; Sgt. A. J. Reid; F/O. D. A. Smith; Sgt. W. C. J. Spencer; Sgt. O. C. Summers; Sgt. D. H. Warner; Flt. Sgt. L. J. Woolley.

WOUNDED OR INJURED IN ACTION.—Sgt. W. A. Gordon.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. W. E. Ball; Sgt. A. Bond; Sgt. W. Brookes; Sgt. W. Clayton; Sgt. E. A. Conybear; Sgt. F. H. Falk; P/C. J. E. Firman; P/O. W. N. Gorton; Sgt. H. Halliwell; Sgt. B. T. Haylock; Sgt. J. E. R. Lyons; Sgt. C. S. McIntyre; Flt. Sgt. J. MacQueen; Act. Sqn. Ldr. P. Nixey, D.S.O.; Sgt. A. C. Robertson; Sgt. P. J. Seckerson; Sgt. A. Smithson; Sgt. J. Strang; Sgt. J. R. Thompson; Sgt. J. Whitfield; P/O. V. E. Woolnough.

MISSING.—Sgt. H. C. Andrews; Flt. Sgt. T. D. Atkinson; Sgt. T. W. Belton; Sgt. W. J. Blatt; Sgt. A. Buckley; F/O. R. A. Coates; Sgt. J. Cockshott; Sgt. J. E. Cook; Flt. Sgt. M. M. Crowe; Sgt. E. K. Davies; Sgt. C. Evans; Sgt. G. C. Falconer; Sgt. H. R. Fidgin; Flt. Sgt. J. Fleming; Sgt. R. K. Frankland; P/O. B. G. Galloway-Wilson; Sgt. L. J. Grove; Sgt. C. J. M. Hall; P/O. E. A. L. Hardman; Sgt. R. D. Holland; Sgt. H. Holmes, Sgt. W. Hurley; Sgt. E. L. Jackman; Sgt. S. C. Kerr; Flt. Sgt. L. J. Lea; Sgt. T. Lee; Sgt. J. Leonard; P/O. P. S. Mackay; Sgt. T. I. McKenzie; Sgt. W. C. McLeish; Flt. Sgt. A. Marvell, D.F.M.; Sgt. J. W. Melhuish; Sgt. D. A. Melville; Sgt. D. J. Monk; Sgt. R. W. Morgan; Sgt. G. L. Musitano; Sgt. J. B. Moore; Sgt. D. N. O'Day; Sgt. C. O'Neill; Sgt. W. E. Pearson; Sgt. A. Prince, D.F.M.; P/O. H. P. Rose; F/O. J. L. Rowe; Sgt. J. Rutherford; P/O. V. W. Saul; Sgt. L. H. Seal; Sgt. D. M. Sharp; Sgt. C. G. Sherratt; P/O. T. B. Skinner; Sgt. D. Smith, B.E.M.; Sgt. W. B. Smith; F/O. P. E. Springman; F/O. G. R. Stead; Sgt. J. L. Turnbull; W/O. C. Wathey; Sgt. T. R. A. West; P/O. C. Wilcock; Sgt. J. R. Williams; Sgt. S. H. Wise; Sgt. J. C. Wrigley; Sgt. T. J. Yarr.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. J. B. Campbell; Flt. Lt. C. W. Grant; A/C.2 W. T. Holmes; Sgt. D. E. Killelea; Sgt. E. W. Mallett; Sgt. J. Milligan; Sgt. B. W. Swaffield.

KILLED ON ACTIVE SERVICE.—Sgt. J. W. Ashby; Sgt. J. P. Barrett; Sgt. J. W. B. Cockburn; Sgt. A. R. Dipple; Sgt. J. T. Goodsir; L.A/C. D. Hope; Sgt. J. M. Laurie; Sgt. N. V. Lloyd; Sgt. J. Macnaughtie; P/O. G. I. Omens; Flt. Sgt. D. W. R. Studd; Sgt. D. G. Weir; Sgt. A. J. Young.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. A. G. Hunter; Sgt. H. S. Thomas; Sgt. P. C. Thompson; Sgt. J. C. Williams.

DIED ON ACTIVE SERVICE.—A/C.2 G. Alexander; A/C.2 J. K. Anderson; A/C.2 A. J. Botcher; L.A/C. A. L. Coster; A/C.1 R. E. Dabbs; A/C.1 J. Duncalfe; A/C.1 W. A. Evans; L.A/C. Z. V. Fieldman; A/C.1 N. Gill; A/C.1 D. J. Glover;

SAMPLE COPY

A SQUADRON IN THE WESTERN DESERT

TOP ROW (Left to Right): Flt. Lt. "Pop" Markhaw; Flt. Lt. "Porky" Jeffries, D.F.C.; Flt. Lt. "Chips" Chopping; P/O. "Pluto" Wilcox; F/O. "Tonker" McMooney. MIDDLE ROW (Left to Right): P/O. "Pete" Harvey; P/O. "Russ" Rustom; Lt. "Ben" Bolt (S.A.A.R.); Sqn. Ldr. "Canada" Bartless, D.F.C.; The C.O., Wing Cdr. G. R. Howie, D.S.O.; Sqn. Ldr. "Pete" Fleming; F/O. "Winkie" Butler; Flt. Lt. "Ted" Whittaker (Long); Flt. Lt. "Negus" Kirkman (Short). BOTTOM ROW (Left to Right): F/O. "Hep" Hepburn; F/O. "Bill" Dawson; F/O. "Percy" Priest; Flt. Lt. "Archy" Archbell; Flt. Lt. "Bill" Coles; F/O. "Duke" Pelling; Flt. Lt. "Flip" Fleming (The So-called Artist); F/O. "Arty" Ashworth, D.F.C. The C.O. is the son of Mr. Robert H. Howie, the well-known golfer and football player.

SERVICE AVIATION

L.A/C. R. G. Gleyne; A/C.1 W. Hardy; L.A/C. C. A. Humby; L.A/C. E. B. Ireland; Sgt. T. McQuire, L.A/C. W. F. Pearce; A/C.1 J. Potts; Cpl. A. Reid; Act. W/O F. K. G. Pelton; A/C.1 G. Spray; L.A/C. L. Teague; A/C.1 P. A. G. Warburton; A/C.1 I. Shaw.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 B. Orton; Cpl. M. M. Rice

Royal Australian Air Force

KILLED IN ACTION.—Sgt. R. Biden.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. P. M. Benison; P/O. C. C. Chataway; A/C.1 T. Dorney; P/O. B. N. Gilbert; P/O. R. J. D. Jeffries; Flt. Lt. M. L. Judell; Sgt. J. V. McLean; Sgt. E. J. Taylor; A/C.1 F. W. Tipping; Sgt. W. L. Winterflood.

MISSING.—Sgt. E. A. Bailey; Sgt. M. M. Fitzgerald; Sgt. W. H. Sams; Sgt. H. M. Spence; Sgt. W. M. Spongberg; Sgt. J. F. Walsh; P/O W. K. Williams.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. C. H. Lomas; Flt. Sgt. R. C. Roberts; Flt Sgt. H. A Wilkins.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J Bradshaw; Flt. Sgt. M. R. Chabot; P/O. H. W. Clarke; Sgt. R. B Glover; Sgt. J. J. Lynch; Sgt. S. A. Morrison.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. A. W. Eden.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. L. D. Jackson; Flt. Sgt. S. L. Reid; Flt. Sgt. J. A. Thompson; Sgt. J. A. M. Turner.

MISSING.—P/O. R. L. Baltzer; P/O. L. D. Bowman; Flt. Sgt. T. R. Cattle; Sgt. T. H. Clarke; Sgt. H. K. Ford; Flt. Sgt. J. M. W. Fortin; P/O. F. A. G. W. Gerty; L.A/C. R. D. J. MacDonald; Sgt. A. A. Margrett; P/O. S. S. Martin; Flt. Sgt. G. R. Montgomery; Morris; Flt. Sgt. W. L. Platt; Sgt. A. Swinderski.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. G. J. Pearson; A/C.1 E. R. Watson.

KILLED ON ACTIVE SERVICE.—Sgt. A. R. Thomas; Sgt. A. N. Urquhart.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. D. J. Clifford.

MISSING.—Sgt. V. P. Cummock; Sgt. B. J. Daley; Sgt. R. R. A. Jones.

Casualty Communique No. 171.

Royal Air Force

KILLED IN ACTION.—Sgt. M. H. Riddel; Sgt. I. Sutherland; Sgt. G. P. Taylor; Sqn. Ldr. D. H. Ward, D.F.C.; P/O. E. Whitaker; P/O. G. J. Woolley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. H. Ives; Sgt. D. R. A. Garrick; Sgt. J. A. Larkin; Sgt. I. MacY. Mackirdy; Sgt. A. I. Mills; Sgt. C. K. Ormston; Flt. Sgt. G. J. Sheahan; Sgt. D. H. Till.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. H. J. Barrie; Sgt. J. E. Browne; Sgt. S. Elmes; Sgt. R. O. Francis; Sgt. A. Jelly; P/O. A. MacTaggart; Sgt. A. F. Scott; Sgt. M. W. Scott; Sgt. H. M. Tapley; Sgt. J. Walker.

WOUNDED OR INJURED IN ACTION E. O. Sayer.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. A. Archer; Sgt. W. Archer; Sgt. R. Armstrong; Sgt. L. T. Baker; Flt. Sgt. W. Barham; Sgt. J. Battersby; Sgt. A. Bentham; F/O. A. W. Bevan; Sgt. G. F. C. Bonner; Sgt. D. P. Brooks; Sgt. D. McC. Brown; Sgt. K. Buchanan; Sgt. H. R. Camfield; Sgt. J. J. Clifton; Sgt. E. V. Conwell; Sgt. J. L. Goddard; Sgt. R. Greenwood; Sgt. D. Haddock; Sgt. J. H. Harte; Flt. Sgt. R. Hunt; Sgt. W. Jackson; Sgt. H. E. Jones; Act. Sgt. A. R. V. Matthissen; Sgt. C. R. Metcalfe; Sgt. A. R. Pain; Sgt. H. A. Payne; P/O. R. M. Ranson; Flt. Sgt. J. W. Stell; Sgt. A. E. C. Squire; Sgt. W. Thompson; Act. Flt. Lt. R. W. A. Turtle.

MISSING.—P/O. J. Abram; Sgt. C. Armitage; Sgt. D. W. Ashworth; Sgt. H. G. Baden; Sgt. J. A. Bloomfield; P/O. E. Booth; Sgt. E. F. W. Booth; Sgt. J. A. Bowyer; Sgt. B. S. Brown; Sgt. N. A. Burroughs; Sgt. A. Cadden; P/O. E. D. Calvert; Sgt. A. H. Cameron; Sgt. B. Chadwick; Sgt. G. H. Chamberlin; Sgt. W. E. Collis; Sgt. W. R. Cook; Sgt. G. B. Cranshaw; Sgt. A. B. Croft; Flt. Sgt. H. L. Davies; Flt. Sgt. H. L. Davis; Sgt. S. E. Davies; Sgt. R. E. Doman; Sgt. H. G. Edge; Sgt. G. T. Edwards, Act. F/O. P. L. Edwards; Sgt. D. Ellis; Sgt. M. A. E. Ennion; Sgt. F. G. Fox; Sgt. A. Garos; Sgt. C. E. Goldring; Sgt. E. B. Goodwin; Sgt. A. L. Gottlieb; Flt. Lt. L. O. Halls, D.F.C.; F/O. L. J. Harcus; Sgt. E. R. Harding; Flt. Sgt. S. V. Harding; Act. Flt. Lt. N. Harrison; Sgt. C. W. Hector; P/O. J. B. Holdsworth; Sgt. H. C. Hood; Sgt. R. G. Horne; Sgt. J. R. Irwin; Sgt. H. Jones; Sgt. W. A. R. King; Act. F/O. A. Kinniburgh; Sgt. C. M. Leaver; Sgt. A. Logie; Sgt. R. McCrae; Sgt. T. A. McGrath; Sgt. A. G. J. McMechan; Sgt. R. G. Mackenzie; Sgt. S. A. Marr; Sgt. J. C. Mason; Sgt. L. S. Melhado; F/O. F. J. R. T. Minster; Sgt. C. J Morgan; Sgt. S. J. Morgan; Sgt. W. F. Morgan; Sgt. J. Moschonas; P/O. G Nadaraja; Flt. Sgt. P. E. Neale; Sgt. J. Oliphant; Sgt. F. E. Ormerod; Act. Flt. Lt. R. E. R. Paramore, D.F.C.; Sgt. N. Peake; P/O. E. A. Phillips; P/O. J. A. Philp; Sgt. J. T. Plant; Sgt. J. H. Pollock; Sgt. H. M. J. Powell; Sgt. S. W. Precious; Sgt. K. S. Preston; Sgt. R. T. Purslow; Sgt. N. J. Rogers; Sgt. E. G. Ronson; Sgt. T. E. Rowan; Sgt. A. B. Scott; Sgt. R. H. Seaton; P/O. F. H. Shackleton; Sgt. R. Slimings; P/O. E. A. Smith; Sgt. E. G. Smith; Sgt. A. Squires; Sgt. K. M. Stuart-Turner; Sgt. D. G. Symons; Sgt. H. Thomas; P/O. I. Treppass; P/O. H. J. Vincent; Sgt. E. Ward; Sgt. W. Watson; Sgt. T. Whelan; Sgt. T. Whittle; Sgt. H. Whittemore; Sgt. J. H. Williams.

KILLED ON ACTIVE SERVICE.—P/O. F. J. Barker; Sgt. R. P. Broadbridge; A/C.1 W. F. Dunbar; F/O. E. B. Graham-Little; Sgt. E. W. Morris; L.A/C. H. W. Palmer; Sgt. D. B. Robinson; Sgt. J. T. Smith; Flt. Sgt. J. B. Tomlinson; F/O. A. N. H. Tustain; W/O. A. C. Walters; A/C.1 G. J. Wiseman; Flt. Lt. P. A. Worrall.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. J. H. Brierley; Sgt. L. D. Cooper; Sgt. E. Hopkins; Sgt. J. Ross.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. B. F. Hoskins.

DIED ON ACTIVE SERVICE.—Sgt. W. V. Bodington; Sgt. S. H. A. Cullen; F/O. D. R. Lea; L.A/C. T. J. Moroney; A/C.1 J. H. Neill; A/C.2 N. W. Pearson; Cpl. T. W. Shand; A/C.1 S. W. Spurling.

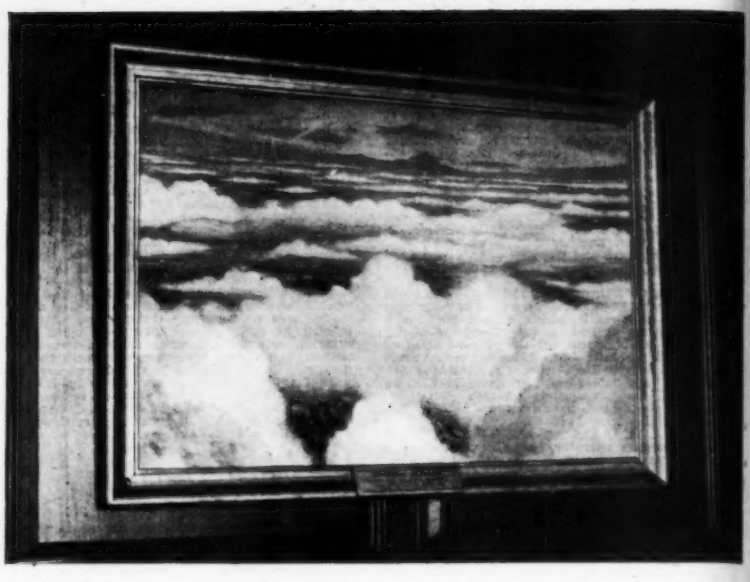
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. W. A. Thompson.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 C. E. Carter; A/CW.1 E. Jenner.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. E. E. Due; Sgt. R. E. Greenwell; P/O. C. A. Harland; P/O. S. T. Manners.



C. R. W. Nevinson's *Battlefields of Britain* which has been accepted by Mr. Churchill as a gift to the Nation. The painting is hung in the Council Room of the Air Ministry.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. L. D. Orbuck; Sgt. R. H. Simes; L.A/C. R. G. Willis.

MISSING.—Sgt. K. Allen; Sgt. A. B. Bennett; F/O. W. D. Blackstock; P/O. M. J. L. Blunt; Sgt. N. C. Darr; Sgt. T. M. Duffy; P/O. A. H. Durrell; Flt. Sgt. A. Greaves; Sgt. R. Hehir; Sgt. T. F. B. McKenna; P/O. V. W. J. Mansell; Sgt. J. O. O'Brien; Sgt. R. D. Powell; Sgt. H. W Price

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. C. W. Buchner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. Warburton.

MISSING, BELIEVED KILLED IN ACTION.—P/O. R. P. Cardinal; Flt. Sgt. E. H. Coone; Sgt. J. R. Cooper; Flt. Sgt. J. L. Hutchison; P/O. H. D. Mackenzie; Sgt. W. Pereira; Sgt. A. D. Robert; P/O. K. H. Taylor.

MISSING.—Sgt. L. L. Aikenhead; P/O. S. J. Beranek; P/O. D. H. Bootsma; Flt. Sgt. R. L. Bradshaw; Sgt. J. W. Brown; Flt. Sgt. R. J. Chisholm; Sgt. N. E. Costigan; P/O. F. R. Donnison; Sgt. R. E. Fuller; Flt. Sgt. A. H. Harris; P/O. J. R. Heslop; Sgt. J. T. Hunter; P/O. W. J. Keough; P/O. P. C. Little; Sgt. H. A. Macdonald; Sgt. O. W. McKenzie; Flt. Sgt. R. H. McRae; P/O. E. M. Marks; Sgt. R. S. Mulhauser; Sgt. R. N. Parham; P/O. G. F. Sanderson; P/O. E. A. Smith; P/O. T. J. Taylor; P/O. B. A. Trapp.

KILLED ON ACTIVE SERVICE.—P/O. W. M Butler; Sgt. D. W. Campbell; Sgt. H. L. Johnson; Sgt. J. I. Mair.

DIED ON ACTIVE SERVICE.—Sgt. F. A. Pyatt.

Royal New Zealand Air Force

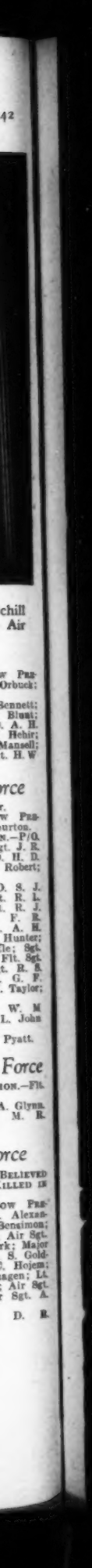
MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. T. Kay.

MISSING.—Sgt. A. W. Corby; Sgt. J. A. Glynn.

KILLED ON ACTIVE SERVICE.—P/O. M. R. Scansie; Sgt. W. A. Shannon.

South African Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. J. S. Iddeson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. B. G. Alexander; 2/Lt. J. McR. Barclay; Lt. L. B. Bensimon; 2/Lt. E. N. Burr; 2/Lt. R. I. Burrage; Air Sgt. D. A. Chalmers; Air Sgt. G. J. De Klerk; Major T. S. Fisher; Major M. H. Fowler; Lt. S. Goldfoot; Act. Sgt. J. Hattingh; Lt. O. C. Hojem; Lt. E. B. M. Holliday; Lt. R. F. Loffhagen; Lt. M. A. Oberholzer; 2/Lt. K. H. O'Reilly; Air Sgt. S. Radomsky; Lt. L. A. Stone; Air Sgt. A. Viljoen.

KILLED ON ACTIVE SERVICE.—Lt. D. R. Thompson.